United States Department of the Interior

Bureau of Land Management
San Juan Public Lands Center, Durango, Colorado

Bureau of Indian Affairs
Southwest Regional Office, Albuquerque, New Mexico

Southern Ute Indian Tribe

Oil and Gas Development on the Southern Ute Indian Reservation
Final Environmental Impact Statement **July 2002**

Volume 2

MISSION STATEMENT

The Bureau of Land Management is responsible for the stewardship of our public lands. It is committed to manage, protect, and improve these lands in a manner to serve the needs of the American people for all times. Management is based upon the the principles of multiple use and sustained yield of our nation's resources within a framework of environmental responsibility and scientific technology. These resources include recreation, rangelands, timber, minerals, watershed, fish and wildlife, wilderness, air and scenic, scientific, and cultural values.

CHAPTER 5 - CONSULTATION AND COORDINATION

CHAPTER 5—CONSULTATION AND COORDINATION

5.1 INTRODUCTION

In accordance with requirements set forth in NEPA, Title 40 CFR, Part 1506.3(c) and the Council of Environmental Quality, a consultation and coordination program was developed and implemented for the preparation of the EIS. The purpose of the program was to ensure that appropriate members of the public and federal, state, and local agencies were contacted, consulted, and given an adequate opportunity to be involved in the environmental analysis and EIS process. This section describes the public and agency scoping process, consultation and coordination program, and issues and concerns identified from public and agency comments and the EIS review process.

5.2 PUBLIC AND AGENCY SCOPING PROCESS

Soliciting comments from various federal, state, county, and local agencies as well as interested organizations and individuals is the first step in the EIS preparation process. Scoping is an information gathering process conducted early in the course of the EIS preparation to identify the range, or scope, of issues to be addressed during the environmental studies and in the EIS, and is required under NEPA 40 CFR 1501.7, 1506.6, and 1508.25.

The scoping process for this EIS began September 15,1995 with publication of a Notice of Intent to prepare an EIS and conduct a public scoping meeting in the *Federal Register*. This began the 30-day comment period. Also, a news release announcing the scoping meeting was sent to local papers and news media (Durango Herald, Southern Ute Drum, and Southern Ute radio station KSUT). A scoping meeting was held on September 26, 1995 at the Rolling Thunder Hall at Sky Ute Casino Lodge and Dining in Ignacio, Colorado.

Meeting attendees were asked to sign an attendance sheet and were provided with a handout containing project information. The meeting began with an opening statement by the BLM. Meeting topics included purpose of the EIS, EIS process, meeting objectives, EIS scope and alternatives, potential public concerns, and opportunities for public comment. A comment period allowed meeting participants the opportunity to voice their questions and concerns. The comment period was followed by an information breakout session. Agency participants included BLM, BIA, and SUIT. A total of 38 individuals attended the scoping meeting. Oral comments provided at the meeting were recorded. Eight comment letters were submitted to the BLM during the comment period.

5.3 SCOPING SUMMARY

A scoping summary report was prepared that documented the scoping process and included copies of attendance sheets; a record of verbal comments; copies of written comment letters; and list of the

key issues, questions, concerns, and comments received. The scoping summary report is available for review and inspection at the BLM office in Durango, Colorado and SUIT office in Ignacio, Colorado. Some of the major issues identified during scoping are presented below (refer to Table 1-1 in Chapter 1 for detailed listing of scoping issues).

- increase the overall scope of the EIS to include oil and gas development in the entire San Juan Basin;
- evaluate the nature and effects of increased production by CBM infill development and/or enhanced recovery by nitrogen/carbon dioxide injection;
- evaluate the cumulative and synergistic impacts of development;
- evaluate the nature and effect of gas migration;
- assess the potential impacts on public health, safety, and welfare;
- describe the environment and analysis of impacts (groundwater, socioeconomic, vegetation, and wildlife resources were most commonly identified);
- determine the effects of nitrogen injection on neighboring wells;
- assess potential air quality impacts, particularly in Class I airsheds (Weminuche Wilderness Area and Mesa Verde National Park);
- assess impacts on surface and groundwater quality;
- address jurisdiction and ensure compliance with rules, regulations, and other land use decisions;
- address impacts on roads and traffic safety concerns;
- determine techniques and effectiveness of long-term reclamation;
- evaluate noise impacts;
- evaluate interim reclamation and maintenance of development sites; and
- general questions about the EIS preparation, process, and content.

5.4 CORE TEAM

At the start of the preparation of this EIS, the BLM, BIA, and SUIT formed a steering committee that has directed the preparation of this EIS. This group is known as the "Core Team" and is composed of representatives from BLM, BIA, and SUIT. The primary purpose of the Core Team is to coordinate all matters of project management, to provide relevant data for analysis to the EIS contractor, to provide statements of purpose and need for action, to define the alternatives to be considered, and to review and comment on the methods used for each stage of the environmental analysis process (e.g., inventory, impact assessment, and comparison of alternatives). Also, the Core Team reviews the results of each stage of the environmental analysis process (e.g., EIS report sections). The Core Team will continue to manage and direct the preparation of the EIS through the final EIS (FEIS) and the Record of Decision.

5.5 AGENCY AND ORGANIZATION CONTACTS

During the preparation of the DEIS, the Core Team and the EIS contractor communicated with and received information and input from various federal, state, and local agencies and private organizations. Table 5-1 lists the agencies and organization that were contacted through letters meetings and telephone by the Core Team or its contractors.

TABLE 5-1 Agencies and Organizations Consulted During the EIS Process
Federal Agencies
Department of Agriculture
Natural Resources Conservation Service ● J.P. Pannel, Soil Scientist ● Chuck Betz, Soil Scientist
San Juan National Forest ● Jim Powers ● Sharon Hatch, Archaeologist

TABLE 5-1
Agencies and Organizations Consulted During the EIS Process

Department of the Interior

Bureau of Indian Affairs
- Fred Ellenbecker, Range Resource specialist
- Jim Freidley, Forester
- Bruce Harrill, Archaeologist
- Jay Herrera, Roads Engineer
- Lee Maytubby, Area Realty Specialist
- Dee Olguin, Realty Officer
- Tony Recker, Forester
- Wayne Wood, Chief of Conservation Department
- Ken Young, Petroleum Engineer, EIS Core Team
- Al Sedik, Area Environmental Coordinator

Bureau of Land Management, Colorado State Office
- Harley Armstrong, Regional Paleontologist
- Jim Rhett, Geologist, Cultural Resource Advisor

Bureau of Land Management, National Science and Technology Center
- Scott Archer, Senior Air Resources Specialist

Bureau of Land Management, Montrose District
- Roger Alexander, Natural Resource Specialist
- Jerry Jones, Physical Resource Advisor

Bureau of Land Management, San Juan Resource Area
- Kent Hoffman, Assistant Area Manager
- Kristie Arrington, Archaeologist
- Ilyse Auringer, Minerals Team Supervisor
- Don Englishman, Environmental Protection Specialist, EIS Core Team
- Terry Galloway, Petroleum Engineering Technician
- Jim Lovato, Minerals Staff Chief
- Leon Lujan, Archaeologist
- Jeff Olson, Geologist
- Dan Rabinowitz, Petroleum Engineer
- Pat Roddy, Petroleum Engineer

Bureau of Land Management, San Juan Resource Area (continued)
- Dave Suanson, Physical Scientist
- Loren Wickstrom, Geologist

Bureau of Reclamation
- Warren Hurley, Archaeologist

TABLE 5-1 **Agencies and Organizations Consulted During the EIS Process**
Fish and Wildlife Service • Terry Ireland, Ecological Services, Grand Junction • Gary Patton, Ecological Services, Denver • Keith Rose, Ecological Services, Grand Junction • Mark Wilson, Ecological Services, Albuquerque
Geological Survey, Water Resource Division • John Turk, Water Quality Specialist
Environmental Protection Agency
Air Quality Division • Gordon Macrae, Air Quality Monitoring Specialist, Region VIII • Robert Wilson, Air Quality Permitting Specialist, Region X
Water Quality Division • Dan Jackson, Water Quality Specialist
Minerals Management Service
• Claire Schaefer, Management Assistant • Steve Rawlings, Analyst
Indian Tribes and Nations
Southern Ute Indian Tribe
Tribal Council • Clement J. Frost, Chairman • Marvin E. Cook, Vice Chairman • Vida B. Peabody, Council Member/Treasurer • Leonard C. Burch, Council Member • Pearl E. Casias, Council Member • Byron Red, Council Member • Howard Richards, Council Member
Maynes Bradford Shipps & Sheftel (Attorneys to the Tribal council) • Sam Maynes • Sam Maynes, Jr. • Tom Shipps
Executive Office • Eugene Naranjo, Executive Officer • Debbie Garner, Assistant to Executive Officer
Community Action Programs • Donna Young, Executive Director
Cultural Preservation Committee • Alden Naranjo, Chairman

TABLE 5-1
Agencies and Organizations Consulted During the EIS Process

Department of Economic Development ● Jim Owen, Director
Department of Energy ● Robert Santistevan, Director ● Bob Zahradnik, Manager of Exploration and Production ● Dick Baughman, Geologist, EIS Core Team ● Jerry Bruner, Gas Marketing ● Rex Richardson, Land ● Rob Voorhees, Engineering Manager ● Robert Jefferson, Red Willow Production Company Operations Manager ● Barbara Wickman, Economist/Geologist, EIS Project Management ● David Gilmore, EIS Project Management ● Karen Anderson, Accounting ● Carl Beal, Severance Tax Administrator
Engineering Department ● Tom Brown, Engineer
Environmental Programs ● Mike Frost, Director ● Cheryl Wiescamp, Environmental Quality Specialist ● Cindy Crist, Water Quality Specialist ● Fran King Brown, Water Quality Specialist ● Virgil Frazier, Air Quality Specialist
Department of Finance ● Larry Beck, Director
Natural Resources Division ● James M. Olguin, Director ● Wayne Wood, Conservation Division Manager *Agricultural Office* ● Latitia Tayor, Agriculture Division Head ● Jim Oglesby, Soil Conservationist ● Don Wickman, Soil Conservationist *Forestry Department* ● Buff Jebsen-Ross, Forestry *Lands Branch* ● Howard Richard, Sr., Chief ● Pathimi Goodtracks, Lands Division Head

TABLE 5-1
Agencies and Organizations Consulted During the EIS Process

Tribal Planning ● Ed Knight, Planner *Wildlife Department* ● Terry Stroh, Wildlife Division Head ● Steve Whiteman, Fisheries Biologist ● Sam Diswood, Wildlife Biologist
Department of Public Works and Operations ● Bob Piccoll, Director (Acting) ● Tom Brown, Utilities Division Manager
Jicarilla Apache Nation
Natural Resources Department ● Alberta Velardy, Natural Resources Planner
State Agencies
Colorado Department of Education
● Brian Pendilay, Director of Public School Finance
Colorado Department of Labor and Employment
● Leslie Moya, Research Analyst
Colorado Department of Local Affairs
● Steve Colby, Administrative Program Specialist ● Teri Davis, Administrative Program specialist ● Michael McGrane, Administrative Officer
Colorado Department of Natural Resources
Division of Wildlife ● Carolyn Adams, Wildlife Biologist ● Gerry Craig, Raptor Biologist ● Scott Wade, Wildlife Biologist Colorado Oil and Gas Conservation Commission ● Sharon Tansey, Production Accounting Supervisor ● Jessie Dunbar, Levy Analyst
Colorado Department of Public Health and Environment
Air Pollution Control Division ● Nancy Chick, Environmental Protection Specialist ● Mike Paukstis, Database Manager

TABLE 5-1
Agencies and Organizations Consulted During the EIS Process

Colorado Department of Revenue
● Rhonda Edfrick, Research Analyst
Colorado Department of Transportation
● Thomas Koglin
Colorado Historical Society
State Historic Preservation Office ● Kaaren Hardy-Hunt, Preservation Planner ● James Green, Compliance Reviewer ● Mary Sullivan, Database Administrator
New Mexico Environmental Department
Air Quality Bureau ● Mary Uhl, Program Manager, Technical Analysis Unit
New Mexico Oil Conservation Division
● Frank Chavez, Supervisor
New Mexico State Revenue Department
● Thomas Clifford, Senior Economist
New Mexico Bureau of Business and Economic Research
● Guy Dameron
County Agencies
Archuleta County, Colorado
Assessor's Office ● Alice Jelnick, Deputy County Assessor Planning Department ● Kathy Ruth, Director
La Plata County, Colorado
Agricultural Extension Office ● Ron Cook, Weed Technician ● Warren Holland ● Frank Joswick Assessor's Office ● Craig Larson, Assessor

TABLE 5-1
Agencies and Organizations Consulted During the EIS Process

Controller's Office ● Carla Distell, Controller Finance Department ● Wayne Bedor, Director Planning Department ● Joe Crane, Director
Montezuma County, Colorado
Assessor's Office ● Nancy Newman, Administrative Assistant
Planning Department ● Lyle Bilberry, Planner
San Juan County, New Mexico
Planning Department ● Linda Thompson, Project Development Administrator
Rio Arriba County, New Mexico
Planning Department ● Patricio Garcia, Director
Local
Bayfield School District 10JTR Durango 9-R School District ● Donna Chase, Finance Assistant ● Amy Malick, Communications Director Ignacio School District 11JT
Organizations and Groups
Alpine Archaeologist Consultants ● Susan Chandler, Archaeologist
Archaeological Consultants ● William Biggs, Archaeologist
Durango Herald ● Amy Maestas, Reporter
Ecosphere Environmental Services ● Ken Heil, Biologist
La Plata County Energy Council ● Gail Aalund, Executive Director

TABLE 5-1 Agencies and Organizations Consulted During the EIS Process
La Plata Archaeological Consultants ● Steven Fuller, Archaeologist
Navajo Reservoir State Recreation Area ● John Weiss, Director
Purgatory Resort ● Linda Kornelson, Payroll Administrator

5.6 PUBLIC AND AGENCY REVIEW OF THE EIS

Public review and comment on the DEIS will occur during a 45-day comment period and will include a formal public hearing to be held during the comment period.

5.6.1 Notice of Availability of the Draft EIS

Concurrent with the distribution of this DEIS, a Notice of Availability (NOA) was published in the *Federal Register* announcing the availability of the DEIS for public review and comment, and the date and location of the public hearing. The NOA publication date marks the beginning of the 45-day review and comment period. The BLM public notice was issued the same day to announce DEIS availability and hearing date.

5.6.2 Public Hearing

About midway through the 45-day review and comment period, a public hearing will be held in Ignacio, Colorado. An open house will precede the hearing to provide opportunity for people to view maps and project information displays and ask questions. A hearing officer will conduct the hearing allowing individuals to formally provide comments on the DEIS. The comments will be documented by a court reporter. Written comments will be accepted at the public hearing and during the 45-day comment period.

5.6.3 Final Environmental Impact Statement

All comments received during the DEIS review and comment period and public hearing will be compiled, analyzed, and summarized. An FEIS will be prepared that provides responses to each substantive comment received on the DEIS. The FEIS also will contain additional information as necessary to support the response to comments. Following publication of a NOA in the *Federal*

Register, distribution of the FEIS, and a 30-day public availability period, the BLM and BIA will issue a Record of Decision summarizing its findings and decisions regarding the Agency and Tribal Preferred Alternative and its determination regarding compliance with NEPA and other regulations.

5.7 DEIS DISTRIBUTION LIST

Table 5-2 presents a list of agencies, organizations and individuals to whom the DEIS was distributed.

TABLE 5-2
List of Agencies, Organizations, and Individuals Receiving Copies of the DEIS

Federal
Department of Agriculture
National Forest Service
Director – Environmental Coordination, Washington DC
Environmental Coordination Staff, Washington DC
Rocky Mountain Region
San Juan-Rio Grande National Forest
Department of Defense
Army Corps of Engineers, Sacramento District/Regulatory
HQ-USAF/LEEV, Environmental Division
Office of the Deputy A/S of the USAF, Environmental, Safety, and Occupational Health
Department of Energy
Federal Energy Regulatory Commision
Office of Environmental Compliance, Washington DC

TABLE 5-2
List of Agencies, Organizations, and Individuals Receiving Copies of the DEIS

Department of the Interior
- Bureau of Indian Affairs
  - Southern Ute Agency
  - Albuquerque Area Office
- Bureau of Land Management
  - Director, Washington DC
  - Resource Planning Team, Washington DC
  - National Science and Technology Center
  - Montrose CO
  - Durango CO
  - Farmington NM
  - Miles City MT
- Bureau of Reclamation
  - Denver CO
  - Durango Projects Office
- Corps of Engineers, Grand Junction CO
- Fish and Wildlife Service
  - Division of Environmental Coordination, Washington DC
  - Environmental Quality Division, Washington DC
  - Regional Director, Denver Federal Center
  - Western Colorado Office, Ecological Services
- Geological Survey
  - National Center, Washington, DC
- National Park Service
  - Division of Environmental Compliance, Washington, DC
  - Mesa Verde National Park
    - Natural Resources Division
    - Superintendent
- OEPC, Denver Federal Center
  - Head – Acquisitions and Serials
- Natural Resources Library
- Office of the Secretary
  - Office of Environmental Policy and Compliance, Washington, DC
- Office of Surface Mining

Department of Labor
- Mine Safety and Health

Department of Transportation
- Environmental Division
- Federal Highway Administration, Office of Environmental Policy

Environmental Protection Agency
- Director – Environmental Coordination Staff
- Office of Federal Activities, NEPA Compliance Division, Washington DC
- Region VIII, Environmental Review/Compliance

SDI Office of Public Affairs

TABLE 5-2
List of Agencies, Organizations, and Individuals Receiving Copies of the DEIS

Southern Ute Indian Tribe
Energy Office Natural Resources Division
State of Colorado

Board of Land Commissioners
Department of Public Health and Environment
    Hazardous Materials and Waste Management Division
Department of Transportation
Division of Wildlife
Highway Department
Historical Society
    State Historic Preservation Office
Oil and Gas Conservation Commission
Parks

County

Archuleta County
    Archuleta County Commissioners
La Plata County
    La Plata County Commissioners
Montezuma County
    Board of Commissioners

Municipal
City of Durango Town of Bayfield Town of Ignacio
Other

Amoco, Denver CO
    Doug Blewitt
    Dave Brown
Conoco, Inc., Farmington NM
Vastar Resources, Inc., Houston TX
    Margaret Melly

TABLE 5-2
List of Agencies, Organizations, and Individuals Receiving Copies of the DEIS

Air Quality Modeling Protocol Contributors

Federal
- Department of Agriculture
  - Forest Service
    - Rocky Mountain Region
      - Tamara Blett
      - Dennis Haddow
- Department of the Interior
  - Bureau of Indian Affairs
      - Ken Young
  - Bureau of Land Management
    - National Sciences and Technology Center
      - Scott Archer
    - Colorado State Office
      - Jim Rhett
      - Kermit Witherbee
    - Montrose Field Office
      - Jerry Jones
    - San Juan Field Office
      - Jim Lovato
      - lyse Auringer
  - National Park Service, Air Quality Division
    - Erik Hauge
    - John Notar
- Environmental Protection Agency, Region VIII
    - Jim Berkley
    - Kevin Golden
    - Shawn McCaffery
    - Mike Strieby

TABLE 5-2
List of Agencies, Organizations, and Individuals Receiving Copies of the DEIS

Air Qulaity Regulatory Agencies
State of Colorado
- Department of Public Health and Environment
  - Air Pollution Control Division
    - Phyllis Breeze
    - Coleen Campbell
    - Chuck Machovec

State of New Mexico
- Environment Department
  - Air Quality Bureau
    - Mary Uhl
    - Martin Rinaldi

Southern Ute Indian Tribe
- Energy Resource Division
  - Dick Baughman
  - David Gilmore
  - Barbara Wickman
  - Bob Zahradnik
- Environmental Programs
  - Mike Frost

Private Organizations
- BP-Amaco
  - Doug Blewitt
  - Dave Brown
- Dames & Moore
  - John Lague
  - Randy Schultz
- Earth Tech, Inc.
  - Francoise Robe
  - Joe Scire
  - Douglas Sheadel
- Vastar Resources, Inc.
  - Margaret Melly

Other Elected Officials

Federal
- Senator Ben Nighthorse Campbell
- Senator Wayne Allard
- Representative Scott McInnis

State
- The Honorable Bill Owens, Governor
- Representative Jim Dyer
- Representative Mark Larson

TABLE 5-2
List of Agencies, Organizations, and Individuals Receiving Copies of the DEIS

The following are oil and gas operators and/or lessees that currently are operating near or within the exterior boundaries of the Southern Ute Indian Reservation boundaries.

BP/Amoco Production Company
- Durango CO
- Houston TX

Apache Corporation, Farmington NM
Robert L. Bayless, Farmington NM
Benson, Montin, Greer Corporation, Farmington NM
Burlington Resources, Farmington NM
Cedar Ridge LLC, Durango CO
Centennial Oil Company, Fort Collins CO
Central Resources Incorporated, Bloomfield NM
Davis Oil Company, Denver CO
Dugan Production Company, Farmington NM
Enervest San Juan Operating, LLC, Durango CO
Famcor Oil Company, Scottsdale AZ
Vernon Faulconer, Inc, Tyler TX
Forty Four Canyon, LLC, Denver CO
Four Star Oil and Gas Company, Farmington NM
Gosney & Sons, Bayfield CO
Joseph B. Gould, Las Vegas NV
Hallwood Petroleum, Inc., Denver CO
J.M. Huber Corporation, Houston TX
Hugoton Energy Corporation, Oklahoma City OK
KCS Mountain Resources, Ltd., Worland WY
Craig Meis – KN Field Services, Grand Junction CO
Mallon Oil Company, Denver CO
Markwest Energy Partners, Ltd., Englewood CO
T.H. McElvain Oil & Gas Limited Partnership, Santa Fe NM
Merrion Oil & Gas Company, Farmington NM
Murchison Oil & Gas Incorporated, Durango CO
Murchison Trusts, Durango CO
Nassau Resources Incorporated, Jerome P. McHugh & Associates, Denver CO
Natural Gas Processing Company, Worland WY

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Oklahoma Silurian Partners, Tulsa OK
Pablo Operating Company, Arlington TX
Palo Petroleum Incorporated
    Dallas TX
    Witchita Falls TX
Questar Energy Company, Farmington NM
Red Willow Production Company, Ignacio CO
SG Interests, Ltd., Durango, CO
San Juan Basin Consortium, Denver CO
Stewart Petroleum Corporation, Durango CO
Texaco, Farmington NM
Thompson Engineering & Production Company, Farmington NM
Universal Resources Corporation, Denver CO
Vastar Resources, Inc.
    Farmington NM
    Houston TX
Williams Production Company, Tulsa OK

Individuals
Gail Aalund; Durango, CO Jane Dreyer; Durango, CO Jim and Theresa Fitzgerald; Bayfield, CO H. Paul Friesema; Evanston, IL Stanley Frost; Ignacio, CO Brian Hoffman; Durango, CO Jamie Karlson; Durango, CO Laura Lindley – Bjork, Lindley & Danielson, P.C.; Denver, CO Bob Miller – McDaniel, Baty & Miller, LLC; Durango, CO Carole McWilliams; Bayfield, CO Ann Rilling, Durango, CO Linda Talley-Branch David and Patti Temple; Durango, CO Neil Whitehead, Conifer CO William Zimsky – Dugan & Associates, Durango, CO

TABLE 5-2
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Organizations/Agencies
Boulder Exchange Corporation, Boulder CO
Colorado Environmental Coalition, Denver CO
Colorado Oil & Gas Association, Denver CO
Greystone Environmental Consultants, Inc., Greenwood Village CO
Independent Petroleum Producers of Mountain States, Denver CO
Rocky Mountain Elk Foundation, Longmont CO
San Juan Audubon Society, Durango CO
Travis Stills Living Land Ranch, Durango, CO
Chairman – Ute Mountain Ute Tribe, Towaoc CO
Western Area Power Administration, Montrose CO
Libraries
Colorado School of Mines Arthur Lakes Library, Golden CO
Colorado State University Libraries Document Department, Fort Collins CO
Cortez City Library, Cortez CO
Department of Agriculture National Agricultural Library, Beltville MD
Dine College Shiprock Campus Library, Shiprock NM
Durango Public LibraryDurango CO
Farmington Public Library, Farmington NM
Fort Lewis College Reed Library, Durango CO
Library of Congress – Anglo-American Acq. Division, Washington DC
Mancos Public Library, Mancos CO
University of Colorado Library, Boulder CO
University of New Mexico Zimmerman Library, Albuquerque NM

SECTION 5.8
FEIS DISTRIBUTION LIST

Alpine Oil & Gas
2016 Forest
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Apache Corporation
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Archuleta County Commissioners
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Durango, CO 81301

B. J. Boucher
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Durango, CO 81301

Balty Quintana
Ignacio Town Manager
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Ignacio, CO 81137

Benson, Montin, Greer Corp.
4900 College Blvd.
Farmington, NM 87402

BIA, Albuquerque Area Office
P.O.Box 26567
Albuquerque, NM 87125-6567

Bill Walsh
USDI-Bureau of Reclamation
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Board of Commissioners
Montezuma County
Administration Office, RM 302
Cortez, CO 81321-3189

Boulder Exchange Corporation
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Boulder, CO 80302

BP America Inc.
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Durango, CO 81301

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Brian Hoffman
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Bureau of Land Management
Atnn: Jerry Jones
2465 South Townsend
Montrose, CO 81401

Bureau of Land Management
Attn: District Manager
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Farmington, New Mexico 87401

Bureau of Land Management
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Washington, D.C. 20240

Bureau of Land Management
Resource Planning Team
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Chairman
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Chief, Division of
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Chief, Energy and Environment
Interstate Commerce Commission
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City of Durango
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Coleen Campbell
State of Colorado
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Colorado Dept. Of
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The Libraries, CSU
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Colorado State Parks
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Denver, CO 80203

Colorado Historical Society
SHPO
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Denver, CO 80203

Colorado Department of Public
Health and Environment
Hazardous Materials & Waste
Management Division
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Colorado School of Mines
Library
Gov't Publications
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Golden, CO 80401-0029

Colorado Oil & Gas Association
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SECTION 5.9
DEIS COMMENTS AND RESPONSES

SOUTHERN UTE INDIAN RESERVATION OIL/GAS DEVELOPMENT DEIS COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD (2/06/01-3/20/01)

Comment	*Date Rec'd*	*Commentor*
A.	2/15/01	Laurie Domler, National Park Service
B.	2/26/01	Noah Volz, Durango Resident
C.	2/27/01	Sage Remington, Southern Ute Grassroots Organization
D.	2/27/01	Balty Quintana, Ignacio Town Manager
E.	2/27/01	Carl Weston, Individual
F.	2/27/01	M. Theresa Fitzgerald, Individual
G.	2/27/01	Heather Snow, Individual
H.	2/27/01	Darsi Olsen, Individual
I.	2/27/01	Ken Jacobsen, US Army Corps of Engineers
J.	2/28/01	Bill Walsh, USDI, Bureau of Reclamation
K.	3/13/01	Carl Watson, State of Colorado, Department of Transportation
L.	3/15/01	Balty Quintana, Town Manager, Ignacio
M.	3/16/01	Cynthia Cody, US Environmental Protection Agency
N.	3/19/01	Mark Pearson, San Juan Citizens Alliance
O.	3/19/01	Mark McMillan, State of Colorado, Air Pollution Control Division
P.	3/19/01	Susan Murray, Durango Resident
Q.	3/20/01	David R. Brown, Amoco Production Company/BP
R.	3/20/01	Lance Astrella, Astrella and Rice PC, Attorneys at Law
S.	3/20/01	Carl Weston, Durango Resident
T.	3/20/01	Warren Hurley, Archaeologist, USDI, Bureau of Reclamation,
U.	3/27/01	Mark Pearson/Gwen Lachelt, San Juan Citizens Alliance/Oil and Gas Accountability Project
V.	3/27/01	Carl Weston, Durango Resident
W.	4/4/01	Cynthia Cody, US Environmental Protection Agency

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IN REPLY REFER TO: DES 00/0057

VIA ELECTRONIC MAIL: NO HARD COPY TO FOLLOW

February 14, 2001

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RE: Draft Environmental Impact Statement for the Southern Ute Reservation Oil and Gas Development, San Juan NM, Montezuma, La Plata, Archuleta Counties, CO.

Dear Mr. Englishman:

The National Park Service has reviewed the aforementioned DEIS and has the following comments:

Air Resources

The Bureau of Land Management, Bureau of Indian Affairs, and the Southern Ute Indian Tribe Department of Energy and Minerals prepared this DEIS to identify and evaluate the potential environmental impacts associated with oil and gas development within the boundaries of the reservation. The DEIS evaluates three alternatives for oil and gas development. Alternative 1 is the No Action alternative. It is the continuation of present management, involving the potential drilling of 269 conventional wells and 81 coalbed methane (CBM) wells. Alternative 2 – Coalbed Methane Infill Development could result in the potential drilling of 269 conventional wells and 367 CBM wells. Alternative 3 - Enhanced Coalbed Methane Recovery is the Preferred Alternative, and could result in the potential drilling of 70 injection wells, 269 conventional wells, and 367 CBM wells. The Reservation where oil and gas development would occur is located southeast of Mesa Verde National Park (NP), a mandatory federal Class I air quality area managed by the National Park Service (NPS). Mandatory federal Class I areas are defined by Congress in the Clean Air Act Amendments of 1977 and receive special protection from air pollution impacts. Due to the nature of this development project, many of the wells would be developed at distances much greater than the closest point between Mesa Verde NP and the Southern Ute Indian Reservation.

Nitrogen oxide (NO_X) emission controls

Alternatives 1, 2, and 3, were each evaluated using three NO_X emission rates from compressor engines: 1.0, 1.5, and 2.0 grams per horsepower-hour (g/hp-hr). The DEIS describes a 1.0 g/hp-hr emission rate as reflecting currently available, clean-burning equipment. An emission rate of 1.5 g/hp-hr reflects recently

permitted equipment, and 2.0 g/hp-hr reflects historically permitted equipment. There are several basic technologies now used to reduce NO_X emissions from natural gas fired compressors used as prime movers in gas fields: lean burn, clean burn, Non-Selective Catalytic Reduction (NSCR), and Selective Catalytic Reduction (SCR). A statistical analysis of gas compressor permits in the RACT/BACT/LAER clearinghouse indicates that, prior to 1997, the median permit limit for NO_X was 2.00 g/hp-hr. However, since then the median limit has dropped substantially to 1.00 g/hp-hr. A review of permits indicates that numerous sources have been issued permits for emission rates that are equal to or lower than the 1.0 g/hp-hr rate evaluated in this DEIS. For example, Williams Field Services received a permit from the State of Colorado for 14 natural gas-fired compressors with lean burn technology at 0.9 g/hp-hr. In 1995, Meridian Oil was issued New Mexico permit NM-0026 for a clean burn natural gas-fired engine at 0.70 g/hp-hr. In 1998, Saba Petrol in California was issued permit CA-0789 for 0.15 g/hp-hr, in which NO_X emissions would be controlled by use of SCR. Based upon these examples, we believe that the compressor emission rates for this project should be held to less than 1.0 g/hp-hr. This is a lower emission rate than is evaluated within the DEIS. The best available control technology for reducing NOx emissions should be adopted, in order to minimize potential impacts at Mesa Verde NP. A-1

Air Quality Impact Analysis

The air quality impact analysis to assess impacts at Mesa Verde NP was performed using CALMET/CALPUFF, a non steady-state modeling system. This model was used to predict if the Prevention of Significant Deterioration (PSD) Class I NO_2 increment might be exceeded, and to predict potential impacts to visibility. The analysis indicates that the impacts would be below the Class I NO_2 significant levels for all averaging times.

As stated in the DEIS (page 4-20), BLM chose to also analyze and report potential visibility impacts using the Federal Land Managers Air Quality Related Values Workgroup (FLAG) Draft Phase I Report (dated May 4, 1999) procedures. NPS has established a 5% change in existing background extinction (corresponding to a 0.5 deciview) as a significant impact threshold. A 10% change in extinction (corresponding to 1.0 deciview) constitutes a likely adverse impact. Table 4-4 indicates that under the Preferred Alternative; there would be 3, 3, and 6 days that would exceed the 0.5 deciview limit for the 1.0 g/hp-hr, 1.5g/hp-hr, and 2.0g/hp-hr scenarios,. respectively. This Table also indicates that all Alternative 2 scenarios would result in days exceeding 0.5 deciview change. Table E-3 of the Technical Support document (Dames & Moore, June 2000) lists the specific values for the Alternative 3, 2.0 g/hp-hr scenario as 8.33%, 8.21%, 7.79%, 5.67%, 5.54%, and 5.13%. Also listed, but not included in the Table 4-4 tally, is a value of 4.99%. Neither the DEIS nor the Technical Document (Dames & Moore, June 2000) provide specific value tables for the Alternative 3, 1.0g/hp-hr and 1.5 g/hp-hr scenarios, or the Alternative 2 1.0g/hp-hr, 1.5g/hp-hr, and 2.0 g/hp-hr scenarios. The NPS was able to obtain the specific values for these other alternatives by examining the project data files located in a second Technical Support Document (Earth Tech, January 2001). While the DEIS does report the number of days that deciview limits are exceeded, it is also important that the specific percentage of deciview change for each of those events is also reported. We believe that these specific values should be incorporated into the Final EIS in such a manner that they are clearly known to the readers. A-2

None of the alternatives or NO_X emission scenarios exceeded a 1.0 deciview level using the May 4, 1999 FLAG procedures. To quantify "significant", the DEIS cumulative visibility impact analysis "assumed a 1.0 deciview "just noticeable change" would be a reasonably foreseeable significant adverse impact, although there are no applicable state, tribal, or Federal regulatory visibility standards" (pages 4-19, 4-21). However, it would not be appropriate to only use this 1.0 deciview value to determine whether an adverse impact would occur. Rather, the 0.5 deciview value is most appropriate for NPS Class I areas. A statement within the DEIS also supports this, page 4-20 states:

"For potential visibility impacts predicted to be at or above a "1/2 just noticeable change" (0.5 deciview) for any day, the FLAG Draft Phase I Report states "The FLM (Federal Land Management Agency) would take into account magnitude, frequency, duration, and other factors in making an adverse impact determination"..."

The Alternative 3, 2.0 g/hp-hr scenario exceeds this 0.5 deciview threshold on six occasions. The Alternative 3, 1.5 g/hp-hr scenario exceeded the 0.5 deciview threshold on three occasions, with values of 7.17%, 7.01%, and 6.93%. Based upon the frequency and magnitude of these predicted visibility impacts, the NPS has determined that Alternative 3, 2.0 g/hp-hr and Alternative 3, 1.5 g/hp-hr may create an adverse impact to visibility at Mesa Verde NP. Given this information, the NPS does not believe that the Executive Summary statement (page ES-7) that "Potential air quality impacts would not be significant under any Alternative, for the entire range of analyzed compressor air pollutant emission rates" can be supported. Neither can the statement in Section 4.2.6 (page 4-14), which states that "No significant, adverse direct and indirect impacts to air quality are anticipated from implementation of the Proposed Action or Alternatives." A-3

Cumulative Air Quality Impact Analysis

The DEIS also presents an analysis that evaluates the cumulative air quality impacts, beginning in Section 4.2.7, page 4-14. Cumulative impacts are effects on the environment that result from the incremental impact of the Preferred Alternative when added to other past, present, and reasonably foreseeable future emissions sources in the area. A 10% change in extinction (corresponding to 1.0 deciview) constitutes a likely adverse impact in a NPS Class I area. Cumulative visibility impacts are presented in Table 4-3, indicating that two days at Mesa Verde NP would exceed the 1.0 deciview change under the Alternative 3, 1.5 g/hp-hr scenario, and that three exceedances would be recorded under the Alternative 3, 2.0 g/hp-hr scenario. Alternative 2, 2.0 g/hp-hr is predicted to have a single day exceeding a 1.0 cumulative visibility impact. The specific contribution made by this proposed project to the cumulative impacts is not discussed, and such an analysis should be incorporated into the Final DEIS. A-4

The NPS recognizes the difficulty in preparing a DEIS that describes the project's potential impacts before the exact number of operational wells and their exact locations are known. Having reviewed the very conservative assumptions used in the impact analysis, we agree with the DEIS statements that actual impacts at the time of development are likely to be less. However, the results presented in this DEIS indicate that numerous visibility impacts would occur. Based upon the frequency and magnitude of those impacts, an adverse impact may occur at Mesa Verde NP under the Alternative 3, 2.0 g/hp-hr and Alternative 3, 1.5 g/hp-hr scenarios. To minimize emissions and the potential for visibility impacts, we recommend the use of controls to reduce compressor engine NO_x emissions to less than 1.0 g/hp-hr. A-5

In addition, the air quality monitoring station at Mesa Verde National Park has been detecting a steady increase in growing season ozone and sulfur levels since the mid 1990's. Impacts to air quality resulting from increased ozone levels should be considered since the park considers this area a Class I airshed and additional fossil fuel production in the subject area could add to ozone levels. A-6

<u>Adjacent Lands</u>

The draft environmental impact statement (DEIS) for Oil and Gas Development on the Southwestern Ute Indian Reservation fails to adequately address possible impacts to adjacent lands from proposed exploration and development activities. The DEIS analyzes, in a programmatic fashion, additional exploration and production of conventional natural gas wells and development of the coal bed methane resource in the San Juan Basin. A-7

Recent increases in natural gas prices coupled with electricity shortages in the west are an indication of a market driven need to increase sources of energy. Well field infill and development of coal bed methane

resources are promising prospects to help alleviate energy shortages according to industry sources. With the average coal bed methane well having a life span of 20+ years, and the promising prospects of vast amounts of this resource available in the San Juan Basin, it is important that the DEIS for oil and gas development on the Southern Ute Indian Reservation contain a thorough analysis of impacts on the immediate and surrounding environment.

Activities analyzed in the DEIS mainly consist of a significant increase in well density (spacing) on approximately 200,000 acres in a 421,000 acre study area. The area consists of Tribal trust lands that are contained in the boundaries of the Southern Ute Indian Reservation. Location maps included in the DIES reveal that the Study Area lies on the Colorado side of the Colorado/New Mexico border, just south of Durango, Colorado. DEIS maps, although not confirmed in the text, reveal that the study area is near the extreme southeast corner of Mesa Verde National Park. The northern boundary of the Study Area parallels U.S. Highway 160, which leads to Mesa Verde's main entrance road.

Analysis of increased gas and coal bed methane exploration and development contained in the DEIS is limited to impacts within the study area itself. The environmental document scantly acknowledges the existence of adjacent National Park Service (NPS) lands, and completely fails to analyze any possible impacts from increased drilling or production activities to NPS lands or visitors. In addition to the document's failure to address possible impacts on areas adjacent to reservation lands, the DEIS states that scoping for the project was completed in 1995. We are concerned that a six year-old scoping effort may not adequately address current issues in need of analysis. A-8

While it is impossible to comment on specific sections of the DEIS due to the document's lack of analysis of adjacent lands, we believe that it is important that the DEIS acknowledge the existence of sensitive NPS resources adjacent to the Study Area. Analysis should include, but not be limited to possible impacts from:

Dust;
Noise;
Drilling and production equipment emissions;
Night lighting; A-9
Viewshed impacts;
Impacts on animal species, including threatened, endangered, and sensitive species that may cross between the study area and adjacent lands;
Offsite ground and surface water quality;
Air quality (including impacts on Mesa Verde's Class I air designation); and,
Safety issues relating to visitor travel near the study area to and from nearby NPS units, particularly on U.S. Highway 160.

We appreciate the opportunity to comment on the draft environmental impact statement for oil and gas development on the Southern Ute Indian Reservation. If you have any questions or specific concerns regarding these comments, please contact me at (303) 969-2036.

Sincerely,

/s/ Laurie Domler
NEPA/Section 106 Specialist

Responses to Comment "A" from Laurie Domler, National Park Service

A1 As stated in the DEIS (page 4-11; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery):

> Maximum direct NO_2 impacts during operations were predicted based on assumed NO_x emissions from reasonably foreseeable CBM recovery wells, injector well and pipelines compressor engines. However, given the uncertain and preliminary nature of potential development, three different NO_x emissions rates were used: 1.0 grams per horsepower-hour (g/hp-hr; which reflects currently available, clean burning equipment), 1.5 g/hp-hr (which reflects recently permitted equipment), and 2.0 g/hp-hr (which reflects historically permitted equipment). The highest emission rate represents compression engines using proven technology which would ensure this level of control could be continuously achieved. The lowest emission rate represents compression engines using emerging technology which would be more difficult to guarantee throughout the LOP [20-year "life of project"].

In addition, the DEIS stated (page 2-38; Chapter 2; 2.7 COMPARISON OF ALTERNATIVES; Summary of Resource Comparisons): "Air Quality - Significant impacts on air quality are not anticipated with the development of any of the three alternatives."

The DEIS also stated (page 4-7; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.1 Issues, Impact Types, and Criteria):

> Air pollution impacts are limited by state, tribal and Federal regulations, standards, and implementation plans established under the Clean Air Act and administered by the applicable air quality regulatory agency (including the SUIT, the CDPHE-APCD or the EPA). ... Air quality regulations require proposed new, or modified existing, air pollutant emission sources (including nitrogen injectors and gas compression facilities) undergo a permitting review before their construction can begin. Therefore, the applicable air quality regulatory agencies have the primary authority and responsibility to review permit applications and to require emission permits, fees and control devices, prior to construction and/or operation. In addition, the U.S. Congress (through the Clean Air Act Section 116) authorized local, state and tribal air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than Federal requirements. Additional site-specific air quality analysis would be performed, and additional emission control measures (including a BACT analysis and determination) may be required by the applicable air quality regulatory agencies to ensure protection of air quality resources.

The Bureau of Land Management, Bureau of Indian Affairs, and the Southern Ute Indian Tribe (SUIT) performed a detailed air quality impact assessment for the DEIS, as required under the National Environmental Policy Act (NEPA). This Act requires that potential environmental

consequences of a Proposed Action and Alternatives be analyzed and disclosed to the public and other interested parties before a decision either denying, approving, or approving with stipulations of alternate activities.

The U.S. Environmental Protection Agency (EPA) has separate authority and responsibility for regulating air pollutant emissions under the Clean Air Act. EPA may delegate some of these authorities and responsibilities to state, tribal, regional, and/or local air quality regulatory agencies (as specified in legally binding "implementation plans"). Even when some activities have been delegated, however, EPA retains oversight responsibility to ensure that all Federal Clean Air Act requirements are implemented, or to withdraw such delegation and implement those requirements itself. EPA and authorized air quality regulatory agencies have the primary authority and responsibility to regulate air pollutant emissions, including determination of the "best available control technology [BACT] for reducing NO_x emissions."

Finally, the land management decision process is made under statutory authority separate from either the NEPA analysis, disclosure, commenting, and response requirements, or the Clean Air Act regulatory process. Federal land management agency decisions must ensure continued compliance with all local, state, tribal and Federal air quality laws, statutes, regulations, standards, and implementation plans. These agencies also have discretionary authority to include operational stipulations in a "record of decision" to limit unnecessary and undue environmental impacts. Since no significant air quality impacts were identified in the DEIS for any Alternative under the three analyzed emission rate scenarios, however, there is no basis that "compressor emission rates for this project should be held to less than 1.0 g/hp-hr."

The Respondent should contact the applicable air quality regulatory agency directly, to request that nitrogen injectors and gas compression facilities be permitted at an emission rate less than 1.0 g/hp-hr.

A2 As stated in the DEIS (pages 4-16 through 4-18; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.7 Cumulative Impacts):

> Since the Alternative 3 (Proposed Action) and cumulative emission sources constitute many small sources uniformly spread out over a very large area, discrete visible plumes are not likely to impact the mandatory Federal PSD [Prevention of Significant Deterioration] Class I areas, but the potential for cumulative visibility impacts (increased regional haze) is a concern. Regional haze degradation is caused by fine particles and gases scattering and absorbing light. Potential changes to regional haze are calculated in terms of a perceptible 'just noticeable change' (1.0 deciview) in visibility when compared to background conditions." Further, "It should be noted that a 1.0 deciview change is not a 'just noticeable change' in all cases for all scenes. Visibility changes less than 1.0 deciview are likely to be perceptible in some cases, especially where the scene being viewed is highly sensitive to small amounts of pollution. Under other view-specific conditions, such as where the sight path to a scenic feature is less than the

maximum visual range, a change greater than 1.0 deciview might be required to be a 'just noticeable change.'

However, this NEPA analysis is not designed to predict specific visibility impacts for specific views in specific mandatory Federal PSD Class I areas based on specific project designs, but to characterize reasonably foreseeable visibility conditions that are representative of a fairly broad geographic region, based on 'reasonable, but conservative' emission source assumptions. This approach is consistent with both the nature of regional haze and the requirements of NEPA. At the time of a preconstruction air quality permit application, the applicable air quality regulatory agency may require a much more detailed visibility impact analysis. Factors such as the magnitude of deciview change, frequency, time of the year, and the meteorological conditions during times when predicted visibility impacts are above the 1.0 deciview threshold (as well as inherent conservatism in the modeling analyses) should all be considered when assessing the significance of predicted impacts.

Table 4-3 (page 4-18; "Predicted Visibility Impacts in Mandatory Federal PSD Class I Areas - Number of Days Above a 1.0 Deciview "Just Noticeable Change") identified potential daily changes in visibility (reconstructed extinction) based on IMPROVE $PM_{2.5}$ (fine particulate matter) samplers operating at Mesa Verde National Park and the Weminuche Wilderness Area during 1997. Potential impacts were reported ranging from no days predicted to exceed 1.0 deciview at either area under Alternative 1 (No Action) under all analyzed NO_x emission rates, to one day at the PSD Class I Weminuche Wilderness Area and up to three days at the PSD Class I Mesa Verde National Park under Alternative 3 (Proposed Action) at an assumed 2.0 g/hp-hr NO_x emission rate. Listings of the complete 365-day analyses for Alternative 3 (Proposed Action) was printed in the "Air Quality Impact Assessment Technical Support Document" (Earth Tech 2000), and complete tabular listings for all analyses (including all three Alternatives under three different assumed emission rate scenarios) were available to the public during the DEIS review period.

However, after the DEIS air quality impact assessment was completed, the USDA Forest Service, USDI National Park Service, and the USDI Fish and Wildlife Service published their "Final FLAG Phase I Report" (Federal Register, Vol. 66 No. 2, dated January 3, 2001), providing "a consistent and predictable process for assessing the impacts of new and existing sources on AQRVs," including visibility. For example, the FLAG report states "A cumulative effects analysis of new growth (defined as all PSD increment-consuming sources) on visibility impairment should be performed," and further, "If the visibility impairment from the proposed action, in combination with cumulative new source growth, is less than a change in extinction of 10% [1.0 deciview] for all time periods, the FLMs will not likely object to the proposed action."

Although the FLAG procedures were primarily designed to provide analysis guidance to Clean Air Act PSD permit applicants, the following revised Table 4-3 uses the "Final FLAG Phase I Report" procedures for this NEPA analysis:

TABLE 4-3
Predicted Visibility Impacts in Mandatory Federal PSD Class I Areas
(Number of Days Predicted to Equal or Exceed a 1.0 Deciview "Just Noticeable Change")

NO_x Emission Rate Scenario	Mandatory Federal PSD Class I Sensitive Area	ALT 1 No Action	ALT 2 CBM Infill	ALT 3 Proposed Action
1.0 g/hp-hr	Mesa Verde Nat'l Park Weminuche Wilderness	0 0	0 0	0 0
1.5 g/hp-hr	Mesa Verde Nat'l Park Weminuche Wilderness	0 0	0 0	0 0
2.0 g/hp-hr	Mesa Verde Nat'l Park Weminuche Wilderness	0 0	0 0	0 1

Based on multiple iterations of the non-steady state CALPUFF dispersion-modeling system, including the CALMET meteorological model, for three different development Alternatives, each with three different assumed compressor engines NO_x emission scenarios, *no* day was predicted to equal or exceed the 1.0 deciview "just noticeable change" level at Mesa Verde National Park Mandatory Federal PSD Class I Area, and only a single day (based on January 19, 1990, meteorology conditions) was predicted to reach the 1.0 deciview "just noticeable change" level at the Weminuche Wilderness Mandatory Federal PSD Class I Area (at a predicted level of 1.083 deciview). Given the numerous "reasonable, but conservative" assumptions applied throughout this analysis (which may actually compound one another), these projected impacts represent an upper estimate of potential air quality impacts which are unlikely to actually occur.

A3 As clearly stated in the DEIS (pages 4-13 through 4-14; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery):

> When reviewing the predicted near-field (Proposed Action) impacts, it is important to understand the "reasonable, but conservative" assumptions made regarding potential resource development. In developing this analysis, there is uncertainty regarding ultimate development (i.e., number of wells, equipment to be used, specific locations). The analysis was also based on a reasonably-foreseeable-development scenario, including several conservative assumptions:
>
> - Maximum measured background criteria air pollutant concentrations were assumed to occur at all locations in the region throughout the LOP.
>
> - All emission sources were assumed to operate at their reasonably foreseeable maximum emission rates simultaneously throughout the LOP. Given the number of sources included in this analysis, the co-probability of such a scenario actually occurring over an entire year (or even 24-hours) is small. While this assumption is typically used in modeling analyses, the resulting

predicted impacts will be overstated.

- All proposed natural gas wells were assumed to be fully operational (no dry holes), and remain operating (no shut ins) throughout the LOP.

- The total proposed injector well and pipeline compression engines (nearly 118,000 hp) were assumed to operate at their rated capacities continuously throughout the LOP (no phased increases or reductions). In reality, compression equipment would be added or removed incrementally as required by the well field operation, compressor engines would operate below full horsepower ratings, and it is unlikely all compressor stations would operate at maximum levels simultaneously.

- Total predicted short-term air pollutant impact concentrations were assumed to be the sum of the first maximum background concentration, plus the maximum cumulative modeled concentrations, which actually occur under very different meteorological conditions and are not likely to coincide.

- Preliminary PM-10 and SO_2 modeling analyses were performed in order to identify and apply the physical geometry for maximum potential impacts in the final analyses.

- The HAP [Hazardous Air Pollutant] analyses assumed all equipment would operate simultaneously at the maximum emission levels continuously throughout the LOP.

Given these numerous “reasonable, but conservative” analysis assumptions, which may actually compound one another, the predicted impacts represent an upper estimate of potential air quality impacts which are unlikely to actually be reached. However, even applying these “reasonable, but conservative” analysis assumptions, most predicted impacts are below applicable regulatory limits, and the scientific evidence is not compelling that reasonably foreseeable significant adverse impacts would occur.

It is important to note that before actual development could occur, the applicable air quality regulatory agencies (including the state, tribe, or EPA) would review specific air pollutant emissions preconstruction permit applications, which examine potential projectwide air quality impacts. As part of these permits (depending on source size), the air quality regulatory agencies could require additional air quality impacts analyses or mitigation measures. Thus, before development occurs, additional site-specific air quality analyses would be performed to ensure protection of air quality.

Similar interpretive qualifying statements were included in the DEIS regarding the predicted cumulative impacts (pages 4-20 through 4-22; Chapter 4; 4.2 AIR QUALITY AND CLIMATE;

4.2.7 Cumulative Impacts)

The Respondent's insistence that potential visibility impacts be compared to a change of extinction threshold of five percent (0.5 deciview, or "½ of a just noticeable change") is inconsistent with the "Final FLAG Phase I Report" cumulative visibility impact analysis procedures published on January 3, 2001. Although the FLAG agencies "are not likely to object" to a single-source visibility impact less than 0.5 decivew, they have clearly stated "If the visibility impairment from the proposed action, in combination with cumulative new source growth, is less than a change in extinction of 10% [1.0 deciview] for all time periods, the FLMs will not likely object to the proposed action." None of these agencies have suggested that the 0.5 deciview threshold apply to a cumulative analysis as stated by the Respondent.

Therefore, based on the "Final FLAG Phase I Report" cumulative visibility impact analysis presented in Comment Response A-2 above (where there would not be any "just noticeable change" in visibility at Mesa Verde National Park), and since no air quality standards or PSD increments were predicted to be exceeded in the Mesa Verde National Park area under any Alternative or NO_x emission rate scenario, it is unclear why the Respondent "does not believe that the Executive Summary statement (page ES-7) that 'Potential air quality impacts would not be significant ...' can be supported."

A4 As stated in the DEIS (page 4-9; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery): "No violations of applicable state, tribal or Federal air quality regulations or standards are expected to occur as a result of direct, indirect, or cumulative CBM development-related air pollutant emissions (including construction and operation)."

For the single day (based on January 19, 1990, meteorology) predicted to exceed the 1.0 deciview "just noticeable change" threshold at the Mandatory Federal PSD Class I Weminuche Wilderness Area, 38 percent of the predicted total 1.083 deciview change was based on existing (Alternative 1 - No Action) sources. Therefore, 62 percent of the predicted impact would be due to Alternative 3 (Proposed Action) sources alone.

Although it is possible that individual impacts could occur due to either Alternative 1 (No Action) or Alternative 3 (Proposed Action) sources alone, it is more likely that each hourly modeled impact would be a mixture of both source groups, or. given specific meteorological conditions, that neither source group would impact a specific sensitive-receptor area at the same time.

A5 Please see Comment Responses A1 and A2.

A6 Back in 1997, the USDI National Park Service was provided copies of the Near- and Far-field Air Quality Modeling Protocols before the DEIS air quality impact assessment was

initiated. In addition, the analysis team talked with USDI National Park Service representatives to identify those parameters which could impact Mesa Verde National Park, and would therefore be analyzed in the DEIS. Until Comment A-6 was received, the only parameters the USDI National Park Service identified were consumption of the PSD Class I increment and potential regional haze (visibility) impacts within Mesa Verde National Park.

Had the USDI National Park Service provided ozone and sulfur dioxide monitoring data at that time, it would have been considered for inclusion in Chapter 3 (Affected Environment) of the DEIS. However, ozone and sulfur dioxide monitoring data were reported in the DEIS (page 3-6; Table 3-1 Measured Concentrations of Regulated Air Pollutants at the SUIT Monitoring Station near Ignacio (in $\mu g/m^3$)).

The DEIS also stated (page 3-4; Chapter 3; 3.2 AIR QUALITY AND METEOROLOGY; 3.2.4 Existing Air Quality):

> The most complete air quality monitoring data available within the Study Area are from the SUIT station near Ignacio (Table 3-1), which has provided continuous measurements since 1987, and are considered to be the best available representation of background air pollutant concentrations throughout the Study Area (SUIT 1997-98). These data are used in the air quality impact analysis to define background conditions, affected by existing sources inside and outside the Reservation.
>
> The maximum pollutant concentrations recorded at Ignacio are well below applicable National Ambient Air Quality Standards (NAAQS) for most pollutants, although hourly concentrations of ozone approaching the federal standard have been observed occasionally."

Although potential sulfur dioxide emissions from the Proposed Action and Alternatives would be minimal (occurring only due to trace levels of sulfur in the diesel fuel used by heavy equipment during construction), maximum sulfur dioxide impacts within Mesa Verde National Park were predicted to be 0.04 (3-hour), <0.01 (24-hour), and <0.01 (annual) $\mu g/m^3$, as reported in the DEIS (page 4-15; TABLE 4-1 Predicted Mandatory Federal PSD Class I Area Cumulative Impacts (in $\mu g/m^3$); Alternative 3 (Proposed Action)). These values are very small when compared with the applicable PSD Class I increments (25, 5, and 2 $\mu g/m^3$, respectively), and infinitesimal when compared with the applicable Colorado and National Ambient Air Quality Standards (695, 365, and 80 $\mu g/m^3$, respectively). Potential impacts in the PSD Class I Weminuche Wilderness Area were predicted to be even less.

As stated in the "Air Quality Impact Assessment Technical Support Document" (page 5; Dames and Moore 2000):

> VOC [Volatile Organic Compounds; precursors to ozone formation] emissions resulting from the proposed development will be negligible, because no natural gas liquids (NGL) will be produced. In addition, the natural gas produced is

almost pure methane and ethane (see Table 2-1), which are not considered VOC's by EPA, because these compounds do not participate in photochemical formation of ozone.

Without a rigorous source-receptor transport analysis, it is unknown why "Mesa Verde National Park has been detecting a steady increase in growing season ozone and sulfur levels since the mid 1990's." However, large sulfur dioxide emission sources directly upwind, and private-motor-vehicle use by the 600,000–700,000 visitors to the Park annually, are potential sources of increased ozone and sulfur levels observed in Mesa Verde National Park.

A7 The EIS analyzes impacts on adjacent land that may be affected by the proposed action or Alternatives (please see Section 4.13, CUMULATIVE IMPACT ASSESSMENT). The EIS Study Area (Figure 1-1) was determined to be the cumulative-impact-assessment area for most resources. Assessments of air quality and socioeconomic impact take place over a larger Study Area, however, because their impacts are more far reaching.

A8 There is no NPS land next to the Study Area. With the exception of air quality impacts, gas development activities in the San Juan Basin should not impact NPS land. Viewshed impacts on Mesa Verde National Park are not predicted to be significant (please refer to Section 4.2).

DEIS comments also help to establish whether additional issues have emerged since the initial scoping effort. When additional issues are identified, we analyze them and address them in the final EIS. If these issues were to present significant new information or circumstances not previously addressed, we would consider reissuing the DEIS. Our analysis of comments, however, suggests that the scoping issues remain contemporary, and that no new, significant issues have been presented through comment on the DEIS.

A9 Although Mesa Verde National Park (the Park) is about two miles away from the western edge of the Study Area, the area of proposed oil and gas development is approximately 20 miles east of the Park. Impacts on Park land are addressed in Sections 3.2.5, Regulatory Framework; 3.3.4.1 TES Plant Species; 3.4.1.3, Stratigraphy; 3.8.3, Archaeological and Historical Sites; 4.2, Air Quality and Climate; and Section 4.13.2.3, Future Oil and Gas Development on nontribal Lands.

The EIS presents detailed analyses of dust, drilling, and production equipment emissions (including impacts on Mesa Verde's Class I Air Designation), as well as other air-quality-related impacts (see Sections 3.2 and 4.2 on Air Quality). Potential air quality impacts are also presented in Sections 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery; 4.2.7, Cumulative Impacts; 4.2.2, Impacts Common to All Alternatives; 4.2.5, Alternative 3 Enhanced Coalbed Methane Recovery; 4.2.8, Mitigation Summary; 4.6.1.2, Impact Types; 4.6.9, Unavoidable Adverse Impacts; and 4.13.3.1, Air Quality.

Noise (Section 4.11) does not impact Mesa Verde. Gas development and operation activities would occur at a distance of 20 miles or more from Mesa Verde National Park.

Night lighting is not an issue. The Hogback, other geographic features, and sheer distance from Mesa Verde NP provide effective screening.

Viewshed Impacts are disclosed in Sections 3.2, 3.9, 4.2, and 4.9.

Wildlife impacts are disclosed in Sections 3.3 and 4.3 and in Appendix G, Biological Assessment. The Biological Resources Section and the Biological Assessment have been revised to more thoroughly describe impacts on Biological Resources. There should be no or very limited interaction between activities in the Study Area and wildlife that inhabit the National Park.

Ground water and surface water quality impacts within the San Juan River hydrologic system are presented in Sections 3.5, 4.5, and 4.13.3.4. The mitigation and "Best Management Practices" presented in Section 4.5 should adequately protect soils and minimize erosion. There is no hydrological connection between downbasin activities in the Study Area and hydrological regimes in Mesa Verde National Park.

Oil and gas production activities on the Southern Ute Reservation do not measurably affect traffic volumes on Highway 160. Most gas industry traffic flows between the Study Area and the Aztec-Farmington areas south of the Study Area. There is very limited, if any, gas industry traffic between Mesa Verde NP and Hesperus.

RECEIVED

FEB 26 2001

Bureau of Land Management
Durango Colorado

Noah Volz
15 Rio Vista Cir
Durango, CO 81301

Feb. 16, 2001

Dear Mr. Englishman:

I have examined the Southern Ute EIS, and I do not feel it accurately assesses the situation and I am not convinced that oil and gas development is the best allocation of this land. Are these additional wells truly necessary? B-1

Greenpeace published a report in the 1970's stating that at the current rate of natural gas expansion coal bed methane is expected to only last another sixty years. With all the price increases we in the Southwestern counties of Colorado have been experiencing it seems that additional production of natural gas will not remedy this problem until at least 10 years in the future. That is not a good precept on which to base the decision to drill these wells. The land that is there can be used to for multiple uses such as raising cattle or as real estate that would bring more property tax revenue to the counties involved. B-2 The EIS doesn't assess all the roads, stations, and pipelines necessary to expand to 706 wells. This expansion will leave that land unuseable after the initial profit and what will be done to clean up there mess after the wells are no longer productive? Will it also be a long time before the oil and gas can actually be harvested? This issue has not been correctly assessed or even mentioned in the current EIS. There is also the issue of using pipelines from the additional wells, will this impact be less than the proposed impact on the land? B-3 Alternatives in the EIS are vague and not well thought out, the scientific evaluation having to do with ecosystem management does not exist therein. What real alternatives or compromises can be considered with the land and biology in mind? B-4

I would appreciate an immediate response to the questions above and a real assessment of the problems that will occur with this expansion. I am a concerned lifelong resident and beleive that additional published research about the negative impacts of this project must be available to the public. Thank you for your continued effort to manage public land in thi most sustainable efficient management.

Sincerly,

Noah Volz
Lifelong Resident

COMMENT B

Responses to Comment "B" from Noah Volz, Individual

B1 Technical evidence regarding reservoir characteristics presented during COGCC hearings (Case 112, DOCKET 004-AW-05, 06) demonstrates that additional production wells are needed for the maximum recovery of the CBM gas reserves in the Fruitland Formation of the Ignacio-Blanco oil and gas field.

B2 The coal bed methane reserves in the Fruitland Formation of the Ignacio-Blanco field are expected to remain economic for approximately 30 to 60 years. Each well begins to produce immediately after completion.

A typical coalbed methane well in La Plata County will pay $277,000 in *ad valorem* taxes to the County and $85,000 in State severance taxes, according to data presented to the COGCC by a consortium of operators in the large infill application of 2000 (Case 112, DOCKET 004-AW-05, 06). Over a 30-year average well life, this equals approximately $12,000 per year for use of 2.5 acres.

B3 Development of a single oil or gas well requires 6 months to a year. This period includes identifying an appropriate location, land surveying, conducting archaeological and endangered-species surveys, approval of appropriate permits and rights-of-way, constructing access road and well pads, well drilling and completion, and connection to a gas-gathering pipeline, as described in Chapter 2.8.

Well development is assumed to occur over a 20-year period. This acknowledges that all the wells envisioned in the RFD would not be developed simultaneously due to physical factors, such as rig availability, as well as economic and strategic factors.

B4 We believe that the Alternatives are responsive to the EIS Purpose and Need, which is to evaluate tribal gas development options and to meet the intent of NEPA to inform decision makers and the public of the reasonable Alternatives and their environmental consequences.

DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)
for
OIL AND GAS DEVELOPMENT ON THE SOUTHERN UTE INDIAN RESERVATION
Bureau of Land Management, Bureau of Indian Affairs and Southern Ute Indian Tribe

PUBLIC COMMENT SHEET

Please note your comments, being specific as possible, on the Draft EIS for Oil and Gas Development on the Southern Ute Indian Reservation, and return this comment sheet by March 20, 2001, to: Don Englishman, BLM, San Juan Field Office, 15 Burnett Court, Durango, CO 81301. Thank You!

The Meeting Structure is Self-defeating to the General Public. I protest!!! C-1

It defuses Public Comment Process

Paige Remington

SUCO

Do you wish to remain on the mailing list to receive information about this project? ___Yes ___No

How do you wish to receive the Final EIS documents? (Please check one)

_____ Printed Summary Only
_____ Printed Final EIS and Summary
_____ Electronic Final EIS and Summary on CD

Name: ______________________________
Organization (if applicable): ______________________________
Address: ______________________________

COMMENT C

Responses to Comment "C" from Sage Remington, Southern Ute Grassroots Organization

C1 The public meeting used an "open house" format. There was no formal agency presentation, but an interdisciplinary team of agency specialists was available to describe all aspects of the DEIS and solicit public comments. The meeting format was designed to provide for one-on-one interaction between agency officials and the public. After many years of conducting public-involvement processes for both large and small projects, we have found that the open house format is the most engaging and least intimidating format for the public. It offers an opportunity for us to discuss and more fully explore the issues with concerned individuals.

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

PUBLIC MEETING
SOLICITATION OF COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT: OIL AND GAS DEVELOPMENT ON THE SOUTHERN UTE INDIAN RESERVATION

TUESDAY, FEBRUARY 27, 2001 - 6:00 p.m.
ROLLING THUNDER HALL - SOUTHERN UTE TRIBE
IGNACIO, COLORADO

AUTHORIZED BY:
JOHN PECOR, ACTING MINERALS STAFF CHIEF
PUBLIC LANDS CENTER
USDI BUREAU OF LAND MANAGEMENT
SAN JUAN FIELD OFFICE
DURANGO, COLORADO

REPORTED BY:
SUSAN K. VANDENBERG, RPR, CSR #98
Professional Court Reporting Services
P. O. Box 3025
Durango, Colorado 81302

RECEIVED
MAR 06 2001
Bureau of Land Management
Durango Colorado

Susan K. VanDenBerg, R.P.R., C.S.R.
Professional Court Reporting Services
P.O. Box 3025 Durango, Colorado 81302
(970) 259-1107

APPEARANCES

REPRESENTATIVES FROM BUREAU OF LAND MANAGEMENT
Walt Brown
John Pecor
Don Englishman
Matt Janowiak
Scott Archer

REPRESENTATIVES FROM THE SOUTHERN UTE INDIAN TRIBE:
Barbara Wickman
Rex Richardson

COMMENTS PROVIDED BY:
BALTY QUINTANA, TOWN MANAGER, TOWN OF IGNACIO
CARL WESTON
M. THERESA FITZGERALD
HEATHER SNOW
DARSI OLSON

Susan K. VanDenBerg, R.P.R., C.S.R.
Professional Court Reporting Services
P.O. Box 3025 Durango, Colorado 81302
(970) 259-1107

PROCEEDINGS

THE FOLLOWING STATEMENTS WERE GIVEN ORALLY TO THE REPORTER:

BALTY QUINTANA
TOWN MANAGER - TOWN OF IGNACIO
970-563-9494.

My name is Balty Quintana, Town Manager with the Town of Ignacio. I work for the Town of Ignacio, and I'm here to state a comment based on our concerns about the effects of heavy traffic as it pertains to the development of the natural gas fields of the intersection of State Highway 151 and 172.

Our desire is to get involvement among the developing corporations, the Tribe, the State of Colorado, and the Colorado Department of Transportation, along with any other entity or agency that may need to be involved to see what needs to be done to upgrade the conditions of that intersection so that the situation, as it exists currently, can be rectified. That's about the extent of it. D-1

COMMENT D

An additional written comment will be provided once we have professional assessment by the Colorado Department of Transportation. That's it. Thank you.

COMMENT D

Responses to Comment "D" from Balty Quintana, Ignacio Town Manager

D1 According to the CDOT, a work plan is being developed for this intersection. The work plan is not yet final, but will probably involve installing a traffic light, improving the turning radius, and increasing the weight capacity of the road surface.

CARL WESTON
3905 HIGHWAY 550
BONDAD, COLORADO 81303
970-247-9594
email: Crweston@mindspring.com.

My name is Carl Weston. My address is 3905 Highway 550, Durango or it's located at Bondad where the Florida-Animas rivers come together. I've been there 35 years. And I'm, I guess I would say, I'm a charter member of San Juan Citizens Alliance, if that makes any difference to anybody.

I've been involved in these issues for a long, long time. They've taken six years to come up with these SU-EIS notices. We get less than 60 days effectively to comment on it. Then you set up this format to explain it where it's a one-on-one thing, where nobody gets to know what anybody else is saying. So there's really no public mutual support in this kind of setup. And my main concerns are how they're handling air quality and water quality.

E1

E2

There are a lot of other things that get involved in it to some extent, but mostly air quality and water quality. We're now involved in

permit application processes with compressor stations. One of them, namely Red Cedar, and it turns out that there's no monitoring for the people who live where the pollution from these compressor stations get to them, but of radiation inversion. All the pollution follows water courses.

And all the non-Indians live along the water courses, because that is the way the land got homesteaded when they opened the reservation. Some of them are up on Florida Mesa, but the private land pretty well follows the water sheds.

We're disenfranchised. There is no clear-cut process for us to address these impacts if we live within boundaries of the reservation. The perception is that the regulatory and oversight powers that are delegated to the Utes is primarily carried out for the Utes and is answerable to the Ute Council, and the Ute Council don't have any provisions for us non-Utes to go in and raise issues.

We can go to individual people, and they are nice to us, but there is no clear-cut mandate of what they have to do for us and if they have to do anything. I think it's an environment justice issue. I'll leave it at that.

E 3

COMMENT E

Responses to Comment "E" from Carl Weston, Individual

E1 For a programmatic EIS such as this, Federal regulations require at least a 60-day public-review period from the date the EPA notice appears in the Federal Register. We provided a comment period of 75 days, from January 5, 2001, until March 20, 2001, and accepted all late comments.

E2 Please see the response to Comment C1.

E3 Environmental Justice (Executive Order No. 12898, February 1994), is "intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority communities and low-income communities access to public information on, and an opportunity for participation in, matters relating to human health and the environment."

EPA guidelines (CEQ 1998) for evaluating the potential adverse environmental effects of projects require specific identification of minority populations when either: 1) a minority population exceeds 50 percent of the population of the affected area, or 2) a minority population represents a meaningfully greater increment of the affected population than of the population of some other appropriate geographic unit, as a whole.

Oil and gas development on the Southern Ute Indian Reservation should not affect human health in area communities–minority, low-income, or otherwise–and will not discriminate against minority or low-income communities in hiring or any other matters.

An extensive effort has been made to give all interested parties access to public information and to provide opportunities to participate in the review process for the project. Please refer to Chapter 5 for a description of the public-notification process.

No specific group, minority or otherwise, is affected discriminatorily by oil and gas development on the reservation. The tribe's development of its resources is obviously most beneficial to itself, but we believe the local economy also benefits, in the form of well-paying jobs and tax income to La Plata County. The EIS will be made available to all interested parties for review and comment, to ensure that the analyses and conclusions regarding environmental justice and all other issues are comprehensive and reasonable.

7

M. THERESA FITZGERALD
1028 C.R. 525
BAYFIELD, CO 81122

I would like to address more than the EIS, the process of the public participation in the EIS. The format that we see here tonight has definitely excluded the public. Many of my friends and neighbors refused to come because they have been at this type of process before. There's no give and take.

It's set up so that people do not talk to each other, and therefore, we can never come to any kind of consensus, any kind of common interest in the process of coalbed methane. I feel like it's been done very deliberately to exclude the public.

F-1

I also cannot understand how a legal EIS can be published with a no-action alternative since NEPA law is very clear on that point. And that's it.

F-2

Susan K. VanDenBerg, R.P.R., C.S.R.
Professional Court Reporting Services
P.O. Box 3025 Durango, Colorado 81302
(970) 259-1107

COMMENT F

Responses to Comment "F" from M. Theresa Fitzgerald, Individual

F1 Please see response to Comment C1.

F2 Analysis of a No Action Alternative is required by NEPA regulations, 40 CFR 1502.14 (d); in this case, "no action" represents continuation of the existing management program.

HEATHER SNOW
2700 C.R. 510
DURANGO, CO.
970-247-4287
email: hsnow@frontier.net

Basically, the EIS is not readable for the layman. None of the information here is for the layman to understand. So I protest, you know. It needs to be written so that everybody can understand it, and that's basically it. G-1

Those guys with groundwater had some information regarding how water, once it leaves the aquifer, it is not going into the rivers anymore. It is going away from the Animas and La Plata rivers. That's bad. That, I understood. G-2

I think they just better stop everything until they get more information. That's it. G-3

COMMENT G

Responses to Comment "G" from Heather Snow, Individual

G1 Some sections could be a bit complex due to the scientific nature of the topics. We have made numerous revisions to the FEIS to make it a clearer document.

G2 Comment noted. Ms. Snow understood the concepts we conveyed at the public meeting.

G3 We have strived to ensure that the information presented in the EIS is that which is needed to make informed decisions regarding future oil and gas development on the Southern Ute Reservation.

DARSI OLSON
P.O. BOX 1021
DURANGO, COLORADO
970-259-4903

I just wanted to make one note that through the BLM last summer, they asked for public comment regarding the 3-M study, and I turned in several pages of my concerns, which I didn't hear back from them. But the bulk of what I wrote about that were my concerns with hydrogen sulfides.

H-1

And again, I'd like to comment on that regarding air quality. I've got concerns to the well drilling and the close proximity to rural residential homes, and since I had ill health after living and walking to a flaring well site, I have had concerns as far as what levels of methane and BTEX, benzene, toulene, ethylene, xylene -- whether levels are being studied in air quality concerns with this environmental impact statement, and specifically, what levels are safe for infants, children, and persons living with environmental illness.

H-2

I, myself, have environmental illness and experienced ill health from air quality at a

flaring well site. Also, I am concerned about the hydrogen sulfides and methane levels that are showing up in domestic well water and in different parts of our community. And I, again, question what levels of H2S and methane are safe for infants, children, and persons with environmental illness. Until we know more about what levels are safe, we are the test. H-3

Children do not deserve to be the test. And that's about it. We must have clean water and air. Everybody deserves clean air and water, land, and food.

Susan K. VanDenBerg, R.P.R., C.S.R.
Professional Court Reporting Services
P.O. Box 3025 Durango, Colorado 81302
(970) 259-1107

COMMENT H

Responses to Comment "H" from Darsi Olsen, Individual

H1 The 3M study does not address hydrogen sulfide occurrence in the Fruitland Formation, but, rather, addresses whether or not 160-acre well spacing would affect methane seepage at the outcrop.
Please note that hydrogen sulfide seeps are a natural phenomenon along the Fruitland outcrop.

To date, the BLM's outcrop-monitoring program has confirmed some increases in hydrogen sulfide concentrations in the soil gas along the Fruitland outcrop on the Southern Ute Indian Reservation. North of the Southern Ute Indian Reservation, we have not observed increases in hydrogen sulfide concentrations.

The occurrence of hydrogen sulfide is difficult to predict. Given its historic occurrence along the outcrop, it is also difficult to determine if CBM development is responsible for all recently observed occurrences of hydrogen sulfide. The BLM continues to monitor for hydrogen sulfide along the Fruitland outcrop.

H2 The EPA is responsible for establishing National Ambient Air Quality Standards for air pollutants considered harmful to public health and the environment in areas where the general public has access ("ambient" locations). The primary standards set limits to protect public health, including the health of "sensitive" populations (such as asthmatics, children, and the elderly). The secondary standards set limits to protect public welfare, including protection against decreased visibility or damage to animals, crops, vegetation, and buildings. To date, the EPA has established these standards for six air pollutants: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter (in two size ranges), and sulfur dioxide. In addition, the U.S. Congress (in the Clean Air Act, Section 116) authorized local, state, and tribal air quality regulatory agencies to establish air quality standards as stringent as, or more (but not less) stringent than, the Federal standards.

The DEIS listed these standards in Table 3-2 (page 3-10; Applicable Ambient Air Quality Standards and PSD Increment Values (in $\mu g/m^3$)).

There are no applicable Federal, Colorado, or New Mexico Ambient Air Quality Standards for ethylene, methane, or BTEX (benzene, toluene, ethylbenzene, and xylene), although the EPA is working with state, local, and tribal governments to reduce emissions of 188 HAPs (including the BTEX chemicals) in the environment. These HAPs are known or suspected to cause cancer or other serious health effects, such as reproductive effects, birth defects, or other adverse environmental effects.

Since the produced natural gas would be nearly pure methane and ethane, no significant BTEX emissions would occur due to the Proposed Action or Alternatives, although CBM recovery wells and injector well and pipeline compressor engines would emit small amounts of formaldehyde. Maximum formaldehyde (also a listed HAP) impacts were described in the DEIS (page 4-12; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced

Coalbed Methane Recovery).

Neither ethylene nor methane is classified as a HAP or has demonstrated toxic health effects, although both chemicals are explosive at high concentrations.

H3 Please refer to the discussions in Chapters 3 and 4 concerning hydrogen sulfide. Since the produced natural gas would be nearly pure methane and ethane, with little or no sulfur, no significant hydrogen sulfide emissions would occur due to the Proposed Action or Alternatives.

Although there are no Federal or Colorado Ambient Air Quality Standards for hydrogen sulfide, the State of New Mexico has established a hydrogen sulfide standard of 0.010 ppm (1-hour average, not to be exceeded more than once per year).

In addition, hydrogen sulfide was removed from EPA's HAP list in 1991, but it is extremely toxic at concentrations above 300 parts per million (ppm), and the ability to smell it (a "rotten egg" odor) is lost in 2 to 15 minutes at 100 to 150 ppm. The Occupational Safety and Health Administration (OSHA) has established a Permissible Exposure Limit of 10 ppm (averaged over an 8-hour work shift), and a Short Term Exposure Limit of 15 ppm (15-minute average).

For any proposed Federal and Indian Oil and Gas Leases where formations would be penetrated that are known (or that could reasonably be expected) to contain concentrations of hydrogen sulfide of at least 100 ppm in the gas stream, BLM Onshore Oil and Gas Order No. 6 (Hydrogen Sulfide Operations) identifies uniform national requirements and minimum standards of performance expected from operators in order to protect public health and safety, as well as personnel essential to maintaining control of the well.

Please also see Comment Response H2.

REPORTER'S CERTIFICATE

STATE OF COLORADO)
) ss.
COUNTY OF LA PLATA)

I, Susan K. VanDenBerg, Registered Professional Reporter, Certified Shorthand Reporter, and Notary Public, States of Colorado and New Mexico, do hereby certify that the said proceedings were taken in machine shorthand by me at the time and place aforesaid and was thereafter reduced to typewritten form by computer-aided transcription under my supervision; that the foregoing is a true and correct transcript of my stenotype notes thereof.

That I am not an attorney nor counsel, nor in any way connected with any attorney or counsel for any of the parties to said action, nor otherwise interested in the outcome of this action.

IN WITNESS WHEREOF, I have affixed my signature and seal this 21st day of February, 2001.

My Commission Expires: 01-03-2003

SUSAN K. VANDENBERG NOTARY PUBLIC STATE OF COLORADO

Susan K. VanDenBerg, R.P.R., C.S.R.
Registered Professional Reporter,
Certified Shorthand Reporter,
and Notary Public

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, SACRAMENTO
CORPS OF ENGINEERS
1325 J STREET
SACRAMENTO, CALIFORNIA 95814-2922

REPLY TO
ATTENTION OF

February 26, 2001

RECEIVED
FEB 27 2001
Bureau of Land Management
Durango Colorado

Regulatory Branch (200175051)

Mr. Don Englishman
Bureau of Land Management
San Juan Field Office
15 Burnett Court
Durango, Colorado 81301

Dear Mr. Englishman:

We are providing comments for the Draft Environmental Impact Statement (DEIS) for the Oil and Gas Development on the Southern Ute Indian Reservation. The Sacramento District's Clean Water Act regulatory authority extends to the portion of the Southern Ute reservation located in western Colorado. The portion of the reservation in New Mexico is serviced by the Albuquerque District.

A review of the DEIS indicates that potential impacts to waters of the United States. However, we recommend that the Final Environmental Impact Statement provide the following additional information to indicate knowledge of and intent to comply with Section 404 of the Clean Water Act:

o A statement of the definition of Waters of the United States as provided in the Federal Register, 33 CFR Part 328.3. I-1

o A statement that prior to the planning of any activity at or in the vicinity of a Waters of the United States, a mapping and a delineation (for wetland areas where needed) of Waters of the United States will be performed to enable planning of the project to avoid or minimize adverse impacts to the aquatic environment. I-2

o A statement that proposed work under the chosen development plan will avoid impacting Waters of the United States whenever practicable. I-3

o Acknowledgement that such work which cannot avoid discharges of fill material into Waters of the United States will be minimized, and 404 permitting from the Corps of Engineers will be sought, including 401 certification from the Environmental Protection Agency for lands within the boundary of Tribal Lands. I-4

o A statement that adversely impacted Waters of the United States will be mitigated per permitting requirements. I-5

COMMENT I

Thank you for the opportunity to comment on the DEIS. If you have any questions, please write to Mr. Nick Mezei or telephone (970) 243-1199, extension 12.

Sincerely,

Ken Jacobson
Chief, Southwestern Colorado
Regulatory Office
402 Rood Avenue, Room 142
Grand Junction, Colorado 81501-2563

Copy Furnished:

La Plata County, 1060 East 2nd Avenue, Durango, Colorado 81301S

Responses to Comment "I" from Ken Jacobsen, US Army Corps of Engineers

I1 We have made the suggested revision in Chapter 4, Section 4.5.2.8.

I2 Please see response to Comment I1.

I3 Please see response to Comment I1.

I4 Please see response to Comment I1.

I5 Please see response to Comment I1.

United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Region
Western Colorado Area Office

2764 Compass Drive, Suite 106
Grand Junction CO 81506-8785

835 E 2nd Avenue, Suite 300
Durango CO 81301-5475

WCD-BWalsh
LND-6.00

FEB 27 2001

RECEIVED
FEB 28 2001
Bureau of Land Management
Durango Colorado

MEMORANDUM

To: Don Englishman, San Juan Field Office, Bureau of Land Management, 15 Burnett Court, Durango, CO 81301

From: Bill Walsh, Team Leader
Land and Recreation Management Team
Resource Management Division

Bill Walsh

Subject: Review comments on the Draft Environmental Impact Statement for Oil and Gas Development on the Southern Ute Indian Reservation, Navajo Unit, Colorado River Storage Project, Colorado

The following comments are being provided by the Land and Recreation Management Team of this office. We have two general comments under the land ownership and land use categories.

The land beneath and immediately surrounding Navajo Reservoir is owned by the federal government. The Bureau of Reclamation has jurisdiction over this land and manages it for the project purposes of the Navajo Unit of the Colorado River Storage Project. Reclamation has a Memorandum of Understanding with the State of Colorado to manage the recreational use of this land which lies within Colorado and also within the Study Area of this draft EIS. It is reasonable to refer to Navajo State Park when speaking of recreation and land use, but we ask that the federal land ownership be recognized whenever speaking of land ownership within the text of the draft EIS and on Map 17. J-1

Map 19, Existing Land Use, of the draft EIS shows the extent of the Pine River Indian Irrigation Project. We would like to point out that portions of the Florida Water Conservancy District which supplies irrigation water also falls within the draft EIS Study Area. We ask that the water conservancy district facilities be recognized as an existing land use and be included in the impact analysis of this EIS. J-2

We have data in GIS format on the locations of the federally owned land and water conservancy district.

COMMENT J

The Animas-La Plata Project has recently been redefined by Congressional Legislation. We ask that the first paragraph on page 3-93 of the draft EIS be changed to read:

"The Animas-La Plata Project is a water storage project that would divert flows of the Animas and San Juan Rivers for municipal and industrial uses. It also would provide for fish and wildlife preservation, recreation facilities, and a cultural resources program. The project would store water pumped from the Animas River in Ridges Basin Reservoir." J-3

Thank you for the opportunity to review the draft EIS. Please contact me at (970) 385-6554 or bwalsh@uc.usbr.gov with any questions concerning this review and to coordinate transfer of GIS data.

Responses to Comment "J" from Bill Walsh, USDI Bureau of Reclamation

J1 We have modified Section 3.6.2 and annotated Map 17 in the FEIS to reflect the Federal land status of Navajo Reservoir.

J2 We have expanded the description of the Florida Water Conservancy District (FWCD) in Section 3.6.4.6. Benefits associated with the FWCD include irrigation for agriculture and livestock grazing, recreation, and flood control. Flood control is not impacted by oil and gas development, and is beyond the scope of this EIS. Although the FWCD is not specifically mentioned in Chapter 4, impacts on irrigation, agriculture, livestock grazing and recreation in the Study Area were analyzed throughout Section 4.5.2 (Surface Water) and Section 4.6 (Land Use and Ownership). The result of these analyses, as described in both the DEIS and FEIS, is that we predict the impacts on these resources to be insignificant.

J3 We have modified Sections 3.6.5.3 and 4.13.2.7 in the FEIS to reflect the current status of the Animas-La Plata Project.

STATE OF COLORADO

DEPARTMENT OF TRANSPORTATION

3803 North Main Avenue
Durango, CO 81301
(970) 385-1400

RECEIVED

MAR 1 3 2001

Bureau of Land Management
Durango Colorado

March 9, 2001

Mr. Don Englishman, Minerals Supervisor
Bureau of Land Management
San Juan Field Office
15 Burnett Court
Durango, Colorado 81301

Re: Draft EIS for Oil and Gas Development on the Southern Ute Indian Reservation

Dear Mr. Englishman:

Region 5 of the Colorado Department of Transportation has reviewed the Draft Environmental Impact Statement (DEIS) for Oil and Gas Development on the Southern Ute Indian Reservation and offers the following comments.

General System Impacts

In Chapter 3-Affected Environment and Chapter 4-Environmental Consequences, all the analyses pertaining to the State Highway System and County Roads are based on 1996 traffic volumes. In our judgment, the proper base year for all analyses should be 2000. The appropriate data for this base year when projected to 2020 could affect results due to anticipated growth in the study area. K-1

Also in Chapter 3, the projection of trips for the baseline traffic data uses an assumption that vehicle trips related to oil and gas operations will be distributed over 365 days a year. This assumption is questionable given the many factors that affect oil and gas well installation. Some of these include weather, holidays, and equipment availability. We suggest an estimate of the actual number of workdays would be more appropriate in calculating the number of vehicle trips per day associated with the proposed action. K-2

In Chapter 4, the discussion on impacts related to traffic volume includes assumptions of various levels of impact. A significant traffic volume impact is defined as one where a 25% increase over background levels would occur. An impact is defined as an alternative with a 10% increase in traffic, and anything less than 10% would be considered to have no perceivable impact. This type of approach is also mentioned regarding accident and congestion on state highways within the study area. It is not apparent why these thresholds were selected nor how they are useful as a basis for conclusions. K-3

Rather than present threshold criteria with no apparent basis, it would be preferable to provide traffic projections of volume, level of service and accidents in order to assess the level of impact from the proposed action. This type of information is provided in the DEIS in the form of tables for Levels of Service. The comparison of the base year and 20-year accident rates per million vehicle miles is useful and should be presented in a similar fashion. K-4

STATE OF COLORADO

DEPARTMENT OF TRANSPORTATION

9806 North Main Avenue
Durango, CO 81301
(970) 385-1400

DOT

Another consideration with regard to the transportation system that should be addressed in more detail is how the U.S. 160 corridor may be affected by this action. It is noted on pg. 3-93 that this highway is the major east-west highway in southern Colorado. It is also relevant that this highway is located approximately one mile north of and parallel to the study area boundary. Due to the importance of U.S. 160 to the region and likely impacts from the proposed action, it seems prudent to assess impacts to this highway in a manner consistent to those within the reservation boundary. K-5

Specific Locations of Transportation Impacts
In the Chapter 4 discussion on Roadway Congestion, pg. 4-162, a reference is made to the current widening of U.S. 550 north of the New Mexico State line. It would be helpful to add that this project is nearing completion. It is a safety improvement and does not add through lanes. The capacity of U.S. 550 from the state line to U.S. 160 will need to be addressed in an Environmental Assessment to determine the location and laneage appropriate to serve the projected 20 year traffic. K-6

One specific location that warrants consideration is the intersection of State Highways 172 and 151 in the Town of Ignacio. This location has been a concern to CDOT and the Town due to existing geometric limitations. The turning radii are not sufficient for large vehicles. Therefore, the impact of the type of drilling equipment expected to negotiate this intersection should be evaluated and mitigation for adverse impacts should be considered. K-7

In addition, the bridge on S.H. 151 over the Los Pinos River east of Ignacio is a concern due to its age and condition. It was built in 1954 and is on our list of structures for future replacement. The section on Impacts Common to All Alternatives, page 4-162, states that bridge weight limitations may require overweight drilling units to find alternative routes. This bridge needs to be evaluated with regard to its ability to accommodate the overweight units. K-8

We appreciate the opportunity to comment on the DEIS. Please contact me at 385-1430, or Wally Jacobson of my staff at 385-1433 if you have questions.

Very truly yours,

Carl J. Watson

Carl J. Watson
CDOT Region 5 Planning/Environmental Manager

CJW:wrj

Cc: R. Reynolds, CDOT Region 5 Transportation Director
E. Perino, CDOT Region 5 Program Engineer
E. Demming, CDOT Region 5 Traffic and Safety Engineer   File: via Jacobson

Responses to Comment "K" from Carl Watson, State of Colorado, Department of Transportation

K1 Information obtained from CDOT and the La Plata County Road and Bridge Dept. this year (2001) indicates that background traffic has increased on the roads within the Study Area since 1996. The predicted amount of oil and gas traffic related to the three Alternatives in the EIS, however, has not changed. Therefore, the result of comparing the predicted amount of oil and gas traffic to year 2000 traffic data would be that the relative intensity of the impacts would be even less than the intensity of the impacts based on 1996 data. The use of 1996 traffic data results in a "reasonable, but conservative" analysis that presents the maximum intensity of transportation impacts from the predicted amount of oil-and-gas-related traffic. For this reason, year 2000 traffic data were not used in the preparation of the FEIS.

K2 Section 3.7.5 presents the assumptions used for projecting trips for the baseline traffic data. Both installation and maintenance trips are assumed to be distributed randomly throughout the year. For the purpose of the study, daily service trips are computed by estimating the actual number of workdays required for each well type per year, then dividing by 365. We believe that the 365-day assumption used in the study is appropriate, rather than a standard 260-day work year, since the well production and service industry truly works 365 days per year to produce and maintain gas flows.

K3 The 10 and 25 percent thresholds of significance presented in Section 4.7.1.1 are based on the professional judgement and expertise of the preparers of the EIS. It is important to note that the transportation analysis of the three EIS Alternatives predicts a maximum traffic volume increase of only 6 percent on any potentially impacted highway in the Study Area (Sections 4.74, 4.7.5, 4.7.6 and 4.7.7). Using the significance criteria in Section 4.7.1.1, these predicted traffic volume increases are defined as having no perceivable impact. This determination is justified, because a 6 percent traffic volume increase would not necessitate any highway upgrades or modifications, unless the increase were from truck traffic alone, which is not the case for this project.

K4 These projections are presented in sections 4.7.4, 4.7.5, and 4.7.6. Neither traffic accident rates nor the number of accidents are expected to increase as a result of any of the three Alternatives considered (Section 4.7.7.3). Projected increases in traffic volumes are not anticipated to create additional hazards or vehicle conflicts. Additionally, substantial amounts of tribal land are off limits to the average person, minimizing further the chance of encounter.

K5 US Hwy.160 is north of and runs parallel to the Study Area boundary, but does not receive much of the gas industry traffic associated with development on the Reservation. Most of the gas industry traffic accesses the portion of the Ignacio Blanco Field in the Study Area from the Aztec, Farmington, and Bloomfield areas. Based on the analysis presented in Section 4.7,

however, it can be assumed that even if all the potential oil and gas traffic related to any of the three EIS Alternatives used Highway 160, the associated traffic volume increase would not be more than 6%. No perceivable impact would result from a 6% traffic volume increase, as described in Comment Response K3.

K6 We have revised Section 4.7.2.2 to indicate that this project is nearing completion.

K7 According to CDOT, the plan to improve this intersection is nearly complete. CDOT Traffic and Safety Engineer Ed Deming has meet with local residents and the Ignacio planning commission to discuss adding a traffic signal to the intersection and changing current parking spacing on the east side of the intersection, to improve the turning radii. Residents are in favor of increasing the turning radii and installing the conduit for future installation of a traffic signal. The weight-bearing capacity of the intersection may be increased, as well.

K8 According to Carl Watson of the CDOT, this bridge is not scheduled for replacement. The CDOT is currently developing a proposal to reconstruct the bridge, however, in order to make it more structurally sound. Funding for this project should be available in 2002.

TOWN OF IGNACIO

P. O. Box 459 • IGNACIO, COLORADO 81137
Phone: 970-563-9494 • Fax: 970-563-9498

RECEIVED

MAR 15 2001

Bureau of Land Management
Durango Colorado

March 14, 2001

Don Englishman, Minerals Supervisor
Bureau of Land Management
San Juan Field Office
15, Burnett Court
Durango, Colorado 81301

Re: Town of Ignacio Draft EIS of Oil and Gas Development South of the Ute Line Comment

Dear Mr. Englishman:

The Town of Ignacio wishes to formally submit this comment to the Draft Environmental Impact Statement for the proposed continued development of Oil and Gas exploration South of the Ute Line.

This comment is submitted in the spirit of attempting to initiate coordination between the numerous governments and corporations involved in the impacts associated with the continued development of the Natural Gas and Oil Fields. Many of the fields are accessed through the intersection of Colorado State Highway 151 and 172 in the middle of Ignacio. L-1

The technical aspect of how the additional heavy truck traffic will impact the intersection referred to above and the study area is addressed in the comment submitted by Colorado Department of Transportation Environmental Manager Carl Watson. The Town requested that the Colorado Department of Transportation (CDOT) review the EIS and submit comment in the town's continued attempt at involving all affected agencies for the needs of this intersection. L-2

Because the operational headquarters of the Southern Ute Indian Tribe is just three quarters of a mile (3/4) north of the intersection of Colorado State Highway 151 and 172 on Highway 172, most of the Tribe's membership are also heavily impacted by the heavy traffic on the intersection. We believe that the Tribe too has similar concerns and indeed the town will be discussing this issue with them in the near future. L-3

Besides of the obvious substandard condition of the intersection for large truck traffic, there are continued safety issues as they pertain to pedestrians, elementary age school children L-4

accessing the elementary school just to the east of the intersection and dust due to the tons of mud dropped on the road surface by a myriad of Natural Gas field development vehicles as they traverse these two State Highway arterioles. L-4 (cont)

We are pleased to have been given the opportunity to comment on this EIS and look forward to working with any and all agencies involved to address our concerns.

Sincerely,

Balty Quintana
Town Manager

cc/ Town Board
Southern Ute Indian Tribe
Colorado Governor Owens
Colorado State Representatives
Colorado Department of Local Affairs
La Plata County Commissioners
Region 5, CDOT

Responses to Comment "L" from Balty Quintana, Town Manager, Ignacio

L1 The traffic analysis concludes that about 66% of the traffic volume associated with the Alternatives in the EIS would use State Highways 140 and 550 (Section 4.7.1.1). Most of the traffic associated with potential oil and gas development would originate from south of the Study Area (e.g., Farmington) and would not pass through this intersection.

L2 Please see Comment Response K7.

L3 Please see Comment Response K7.

L4 According to Carl Watson of the CDOT, this intersection is currently the subject of a Traffic/Safety Project, and CDOT has meet with local residents and the Ignacio city planner to discuss signalizing the intersection, with the objective of making it safer for all pedestrians. Residents favor increasing the turning radii and installing conduit for future installation of a traffic signal. The weight-bearing capacity of the intersection may be increased, as well. The issue of dust near this intersection is a CDOT responsibility. As noted in Comment Response K3, the maximum increase of traffic volumes as a result of any of the three EIS Alternatives is 6 percent. This potential increase is considered to have no perceivable impact.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
999 18TH STREET - SUITE 300
DENVER, CO 80202-2466
http://www.epa.gov/region08

March 16, 2001

REF: EPR-EP

Frank Salwerowicz
Bureau of Land Management
Colorado District Office
2850 Youngfield Street
Lakewood, Colorado 80215

Bureau of Land Management
San Juan Field Office
Attn: Donald Englishman
15 Burnett Court
Durango, Colorado 81310

RE: Extension Request for Comment Period for the Draft Environmental Impact Statement for Oil and Gas Development on the Southern Ute Indian Reservation (CEQ #010015)

Dear Mr. Englishman:

We are requesting an extension of the comment period until EPA has the opportunity to review the necessary documents that were omitted from the DEIS. M-1

Page 2-75 of the DEIS identified documents for BLM Conditions of Approval, general requirements and standard plan of operations that were to be provided in Appendix E, Environmental Protection Measures. However, Appendix E has omitted: BLM Conditions of Approval Coal-bed Methane Completions; and BLM General Requirements For Oil and Gas Operations on federal and Indian Lands. In addition, SUIT general guidelines that were not included in Appendix E are: SUIT General Well Site Conditions of Approval; and SUIT General Pipeline Right-of-way Stipulations. M-2

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The DEIS also indicated on page 2-74 that the following documents would be included in Appendix D.

- Onshore Oil and Gas Orders,
- Onshore Order #1; Approval of Operations,
- Onshore Order #2; Drilling Operations,
- Onshore Order #3; Site Security,
- Onshore Order #4; Measurement of Oil,
- Onshore Order #5; Measurement of Gas,
- Onshore Order #6; Hydrogen Sulfide Operations,
- Onshore Order #7; Disposal of Produced Water,
- Draft Onshore Order #8; Workovers and Subsequent Well Operations (includes abandonment). Currently draft status, but being used as interim guidance,
- Notice to Lessees,
- NTL-88-2-Colorado; Paying Well Determinations and Venting and Flaring Applications for Coal Bed Methane Wells, and
- NTL-91-1-MDO; Bradenhead Testing.

M-2 (cont)

Section 2.9.1, Page 2-74 states, "BLM Onshore Oil and Gas Orders and Notices to Lessees will be applied as standard operating procedures to individual projects and operators and are provided in Appendix D." Although we have copies of the Onshore Orders that are listed above because they are used on federal oil and gas leases, we do not have the specific NTLs that are listed and stated by the DEIS to be included in Appendix D.

Section 2.9.1 on Page 2-74 also refers to SUIT General Well Site Conditions of Approval and General Pipeline Right-of-Way Stipulation located in Appendix D. We do not have copies of these documents, and they have also been omitted from Appendix B.

It is important to provide the public with adequate information to review the document. It is recommended that BLM cite the specific language in the reference that is used to support the DEIS. The entire document is not required to be included in the DEIS and EPA does encourage lowering paper usage. However, it is important to supply the reviewer or reader with enough information to understand the requirements or information that is being referred to in other documents. In the future BLM may want to consider posting these documents on the Internet and providing the web addresses for them. They could also be included on a CD document and hyperlinked to the appropriate website.

M-3

We are requesting that BLM supply EPA and others who may have requested these documents so that we the opportunity to complete our review of the DEIS. In addition, we are requesting that the comment period be extended to allow adequate time to review the documents that were missing. An additional week for review purposes after we have received a complete set of the documents omitted form the DEIS will be sufficient. If you have any questions related to the missing documents, please contact Gregory Oberley at (303) 312-7043. M-4

Sincerely,

Cynthia Cody, Chief
NEPA Unit
Ecosystems Protection Program

Responses to Comment "M" from Cynthia Cody, US Environmental Protection Agency

M1 The requested information was transmitted to the EPA on 3/21/01. The transmittal letter documented the verbal agreement between BLM and EPA that EPA would submit comments within one week of receiving the requested information.

M2 We have revised Section 2.9.2 and Appendix E in the FEIS in response to this comment.

M3 Please see the response to comment M2. The DEIS was made available on the Internet at ftp://ftp.co.blm.gov./pub/sutcdrafteis/pdfs/. This site has been updated and now includes the FEIS and its revised references and appendices. Both the DEIS and FEIS were/are available on CD, as indicated in the "Dear Reader" letters that were sent to all parties on the mailing list before distribution of both the DEIS and FEIS.

M4 Please see response to comments M1 and M2.

San Juan Citizens Alliance

Organizing for the people and land of the San Juan Basin

March 18, 2001

Mr. Cal Joyner
San Juan Field Office Manager
Bureau of Land Management
15 Burnett Court
Durango, CO 81301

Via fax: (970) 385-1243

Dear Mr. Joyner:,

The San Juan Citizens Alliance requests a 30-day extension of the public comment period for the Southern Ute Indian Tribe Draft Environmental Impact Statement. As the Alliance staff, members, and consultants review the document it has become clear that March 20 does not allow enough time to provide the level of detailed comments that the Alliance typically provides on NEPA documents. The extensive experience of the Alliance in the area of oil and gas would benefit the interdisciplinary examination of the oil and gas development in the San Juan Resource Area. N-1

Also, it has come to our attention that other federal agencies have not received full information concerning the project nor have their concerns been met before release of the DEIS. An extension of time would benefit those agencies and the public that depends upon them for a thorough analysis as part of the EIS process. N-2

Further, it is my understanding that the DEIS was base on an incomplete and inadequate Biological Assessment and that the Endangered Species Act consultation process has yet to be completed. The Alliance further requests that the DEIS comment period be held open until impacts, alternatives, and mitigation measures identified by the Fish and Wildlife Service are revealed to the public for analysis and comment. N-3

Finally, the DEIS was published and provided to the public without any figures printed in the document. The lack of supporting figures has made public review of the DEIS extremely difficult and time-consuming. In order that the NEPA process is carried out in a manner that fully informs decisionmakers and the public, fully includes the public and other agencies, and avoids the need to reopen this NEPA process through contentious and costly litigation after the EIS becomes final, it is in everyone's best interests to provide reasonable time for public comment. Closing the public comment period at this time would not be consistent with your stated dedication to fully involve the public and fully comply with federal laws. N-4

Thank you for your conscientious consideration of this request. Please call me at 970-259-3583 if I can be of any further assistance in this matter.

Sincerely yours,

Mark Pearson

Mark Pearson
Executive Director

cc: Ms. Ann Morgan

863 1/2 Main Avenue • P.O. Box 2461 • Durango, Colorado 81302 • 970-259-3583
Fax: 970-259-8303 • mpearson@frontier.net • http://www.sanjuancitizens.org

Responses to Comment "N" from Mark Pearson, San Juan Citizens Alliance

N1 The BLM and the SJCA agreed during a 3/20/01 phone conversation that the SJCA would submit its comments by 3/30/01.

N2 Please see response to comments M1, M2, and M3.

N3 Consultation with the United States Fish and Wildlife Service was in progress when the DEIS was issued, and the DEIS contained a complete wildlife impact analysis for public review. USFWS consultation will be completed before the issuance of the Record of Decision for this EIS. The final Biological Assessment is included in Appendix G. The wildlife impacts and mitigation disclosed in the final Biological Assessment and the FEIS do not differ significantly from the impacts and mitigation disclosed in the DEIS.

N4 The DEIS was published with printed figures in the document. The BLM underestimated the number of printed copies that would be requested. Consequently, some readers received the DEIS as a printed document with an enclosed compact disc containing electronic versions of the figures. The BLM did offer to print the figures if requested and copies of the DEIS and all figures were available at the San Juan Public Lands Center. While this may have made the review more time consuming for some parties, the BLM made every effort to meet the public's needs related to the DEIS. The comment period for the DEIS was 75 days. The DEIS was also available on the Internet at ftp://ftp.co.blm.gov./pub/sutedrafteis/pdfs/. This site has been updated and now includes the FEIS. Both the DEIS and FEIS were/are available in their entirety on CDs. Please also see Comment Response M3.

STATE OF COLORADO

Bill Owens, Governor
Jane E. Norton, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

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Colorado Department of Public Health and Environment

March 15, 2001

RECEIVED
MAR 19 2001
Bureau of Land Management
Durango Colorado

Don Englishman
Minerals Supervisor
Bureau of Land Management
San Juan Field Office
15 Burnett Court
Durango, CO 81301

Re: Draft EIS for the Oil and Gas Development on the Southern Ute Indian Reservation

Mr. Englishman:

On approximately February 1, 2001, the Air Pollution Control Division received your request for a review of the Draft Environmental Impact Statement (DEIS) for the Oil and Gas Development on the Southern Ute Indian Reservation. Thank you for taking the time to inquire about air quality requirements in this area. The following information should be reviewed for its applicability to the proposed project.

__Modeling Issues__
In general, model selection and application appears to be reasonable for the scope and purpose of this study. There is one possible oversight that has been found. It involves stack diameters at sources on tribal lands.

Table 6-4 on pages 38-40 – "Emission Parameters for Sources on Tribal Lands Included in the Cumulative Impact Analysis" – contains systematic errors in stack diameters. The diameters are too high by a factor of twelve. This error appears to only affect existing tribal sources and not the inventories provided by the State of Colorado (Table 6-2) or the State of New Mexico (Table 6-3). In addition, this problem appears to only affect the near-field modeling (ISCST3) and not the far-field modeling (CALPUFF). For example, the stack diameters for some of the same sources in the far-field CALPUFF modeling are shown as being correct (see Tables A-1 through A-3). This suggests that the stack diameter error was corrected for the CALPUFF modeling. It's possible that the actual ISCST3 modeling has used correct stack diameters and that the error exists only in the table. The Division has O-1

not checked the actual ISCST3 files. If it turns out that the error exists in the ISCST3 modeling, then the near-field cumulative impacts analysis estimates for these sources will not be correct (see recommendations at the end of this letter). O-1 (cont)

For near-field ISCST3 modeling, overestimation of stack diameters by a factor of 12 (while keeping stack gas exit velocities constant, which appears to be the case) could cause a dramatic increase in estimated near-field ground-level concentrations.

To illustrate the magnitude of this oversight, some exploratory modeling follows. It is based on EPA's screening-level model SCREEN3, which should tend to over estimate impacts for annual averages. Consider the Red Cedar Cox Canyon facility. According to Table 6-4, one of the engines (or perhaps a bank of engines) has a potential-to-emit of 189 tons per year of NOx from a stack that is listed with a height of 5.8 meters, exit velocity of 37.7 m/s, and temperature of 655 K. Table 6-4 also suggests there is a nearby building with a height of 7.3 meters and width/length of 18.3 meters. If an incorrect diameter of 3.05 meters is used, SCREEN3 predicts a near-field 1-hour maximum NOx concentration of 900 micrograms per cubic (ug/m3) meter. This is an annual average of about 72 ug/m3 assuming a scaling factor of 0.08. The value occurs at a receptor 50 meters from the source. In contrast, modeling with a correct diameter of 0.25 meters increases the 1-hour average ground-level concentration to over 13,000 ug/m3! This is an annual NOx concentration of about 1000 ug/m3. O-2

If the same source is modeled without building downwash, the maximum 1-hour average impact at simple terrain receptors beyond 100 meters would be about 4 ug/m3 (0.32 ug/m3 annual average) based on the incorrect diameter. In contrast, SCREEN3 suggests the 1-hour maximum would climb to about 645 ug/m3 (or a 52 ug/m3 annual average) if a correct diameter is modeled. O-3

The results above illustrate that the use of artificially large stack diameters, while holding the stack gas exit velocity constant, can cause large decreases in the calculated near-field concentration in situations with and without building downwash.

In addition to the stack diameter issue, it's also worth noting the dramatic effect that building downwash can have on concentration levels.

The Division recognizes that it would be a huge and probably unrealistic effort to model every source in the study area in detail as part of an EIS. Despite the possible quality assurance problem with respect to stack diameters, the draft EIS clearly shows that a comprehensive effort has been made to estimate existing and future air quality. The data assembled by the EIS process has been very useful to the Division for other studies.

The Division also recognizes that current EPA modeling methods for estimating near-field NO2 concentrations tend over predict actual NO2 concentrations. While this is due in part to the use of allowable versus actual emissions, the real issue is that current regulatory modeling systems do not treat atmospheric chemistry realistically in the near-field.

RECOMMENDATIONS FOR FINAL EIS

1. The stack diameter issue should be addressed. Since it is difficult to accurately model every source in an EIS covering a large area, one possible solution would be to install a more comprehensive monitoring network in the study area as suggested below. O-4

2. A more extensive monitoring network is recommended for the study area. At a minimum, it should include PSD-quality meteorological towers, NO2, and O3 monitors. Other pollutants should be considered as appropriate. O-5

Visibility and Other Air Quality Related Values
This section pertains to the review of the visibility and other air quality related values (AQRVs) for the DEIS addressing Oil and Gas Development on the Southern Ute Indian Reservation.

Class I Visibility
The regional haze analysis indicates the Limit of Acceptable Change as established in the FLAG report will be exceeded by Alternatives 2 and 3 (the proposed action).

Class I Acid Deposition
The DEIS indicates the potential impacts of the proposed alternative would be below the "limit of acceptable change."

Recommendations
The potential for noticeable regional haze degradation is of concern. The agencies should ensure the protection of visibility in Mesa Verde National Park and Weminuche Wilderness Area when making a final decision on the scope of the project and conditions required during development of oil and gas wells on the Southern Ute Indian Tribal lands. The Division recommends that new development be required to meet emission rates of currently available, clean burning equipment (1.0 g/hp-hr of NO_x). O-6

General Background and Observations
It will be appreciated that noise and dust suppression actions be taken in all appropriate phases of this work. It will be appreciated that odor suppression actions be taken in all appropriate phases of this work and operation as well. O-7

Generally projects of this magnitude can benefit from Pollution Prevention (P2) strategies. The Colorado Department of Public Health and Environment has its own P2 team designed to identify and assist in various opportunities such as yours. I encourage you to contact Kirk Mills of the P2 team at 303-692-2977 for more information about these often cost-effective and environmentally-preferable approaches. O-8

If you have any questions or feel as though you need more information please contact me at (303) 692-3140 or the Colorado Air Pollution Control Division's Stationary Source Program at (303) 692-3150.

Sincerely,

Mark J. McMillan
Planning and Grants Specialist
Colorado Air Pollution Control Division

Responses to Comment "O" from Mark McMillan, State of Colorado, Air Pollution Control Division

O1 You identified an error in the emission stack diameters listed in Table 6-4 of Volume I - Emissions Inventory and Near-field Analysis of the Air Quality Impact Assessment Technical Support Document (page 38, Emission Parameters for Sources on Tribal Lands Included in the Cumulative Impact Analysis). This error involved a unit-of-measure conversion factor for the emission source stack diameters. The erroneous values were used only in the carbon monoxide and nitrogen dioxide near-field production phase analyses, and not the near-field construction, near-field formaldehyde, or any of the far-field modeling analyses.

The correct emission parameters for sources on tribal land (including the emission stack diameters) have been revised in Table 6-4 of the "Air Quality Impact Assessment Technical Support Document" (pages 38 through 40; Dames and Moore 2000). In addition, the carbon monoxide and nitrogen dioxide near-field production phase impacts were reanalyzed, based on the correct emission stack diameter values. The correct results are somewhat higher than the erroneous values reported in Dames and Moore (2000).

Specifically, the maximum total (background plus modeled) cumulative carbon monoxide values were predicted to range between 4,376 to 5,530 $\mu g/m^3$ (1-hour) and between 2,931 to 3,651 $\mu g/m^3$ (8-hour), compared to the values reported in Dames and Moore (2000): between 3,637 to 5,562 $\mu g/m^3$ (1-hour) and between 2,912 to 2,929 $\mu g/m^3$ (8-hour). These revised values are still well below the applicable carbon monoxide NAAQS of 40,000 $\mu g/m^3$ (1-hour) and 10,000 $\mu g/m^3$ (8-hour), respectively.

The maximum cumulative annual nitrogen dioxide values varied, based on the three different assumed compressor engines' NO_x emission scenarios, and have been revised in Tables 6-6 through 6-8 of the "Air Quality Impact Assessment Technical Support Document" (pages 49 through 51; Dames and Moore 2000). Revised isopleths of the predicted annual average nitrogen dioxide concentrations are also provided for Figures 6-3 through 6-5 (pages 52 through 54; Dames and Moore 2000).

The correct values range as follows: 31.2 to 37.6 $\mu g/m^3$ for the 1.0 g/hp-hr scenario (which reflects currently available, clean-burning equipment); 31.9 to 38.7 $\mu g/m^3$ for the 1.5 g/hp-hr (recently permitted equipment), and 32.6 to 39.8 $\mu g/m^3$ for the 2.0 g/hp-hr (historically permitted equipment).

As stated in Dames and Moore (2000), these maximum modeled cumulative air quality impacts are above the nitrogen dioxide PSD Class II increment of 25 $\mu g/m^3$. Since this air quality impact assessment is not a regulatory PSD increment consumption analysis, these results are presented for disclosure purposes only. Given the reasonable but conservative nature of the modeling analysis, the speculative nature of the programmatic EIS, and the likely inclusion of existing emission sources that are not subject to the PSD program, it is unlikely that actual exceedances of the nitrogen dioxide PSD Class II increment would occur.

The maximum total (background plus modeled) annual cumulative nitrogen dioxide values (depending on the assumed compressor engines NO_x emission scenario) range from 46.3 to 54.9 $\mu g/m^3$, still well below the applicable nitrogen dioxide NAAQS of 100 $\mu g/m^3$.

O2 Please see Comment Response O1.

O3 Please see Comment Response O1.

O4 As described in Comment Response A1, Federal land management agency decisions must ensure continued compliance with all local, state, tribal, and Federal air quality laws, statutes, regulations, standards, and implementation plans, as required by Section 176(c) of the Clean Air Act. These agencies also have discretionary authority to include operational stipulations in a "record of decision," based on oil and gas lease terms (Section 6) that require the lessee, within the lease rights granted, to take measures deemed necessary by the lessor for the conduct of operations in a manner that minimizes adverse impacts on air quality, as well as other resources. This may include requirements for post-approval air quality monitoring.

As stated in the DEIS (page 4-25; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.8 Mitigation Summary-Monitoring):

> The need for, and the design of, additional monitoring could include the involvement of the EPA Region VIII Federal Leadership Forum and applicable air quality regulatory agencies. Based upon future recommendations, operators could be required to cooperate in the implementation of a coordinated air quality monitoring program.

Please also see Comment Response A1.

O5 The need for, and specific design of, additional monitoring would be determined in the Record of Decision, after the NEPA environmental analysis process is completed. It is likely, however, that any required air quality mitigation measures (including monitoring) would be based on the uncertainty that the Proposed Action or Alternatives may proceed without causing "significant, adverse" air quality impacts.

As stated in the DEIS (page 4-9; 4.2 AIR QUALITY AND CLIMATE; 4.2.1 Issues, Impact Types, and Criteria):

> Air quality regulations require proposed new, or modified existing, air pollutant emission sources (including nitrogen injectors and gas compression facilities) undergo a permitting review before their construction can begin. Therefore, the applicable air quality regulatory agencies have the primary authority and

responsibility to review permit applications and to require emission permits, fees and control devices, prior to construction and/or operation.

They can also require pre- and post-construction monitoring. The type of "more extensive monitoring network" recommended by the Respondent is best required through the air pollutant emission source permitting process. The Respondent should contact the applicable air quality regulatory agency directly, to request that "PSD-quality meteorological towers, NO2, and O3 monitors" be required before issuing an air pollutant emissions permit.

O6 Please see Comment Responses A1 and A2.

O7 Noise and dust impacts and mitigation measures are presented in Section 4.2,, Section 4.11, Section 4.13.3.1, and Section 4.13.3.10. Odor was not considered to be an issue because the natural gas that would be produced under any of the Alternatives is "sweet" (does not contain sulfur compounds), so no objectionable odors are likely to occur.

O8 The San Juan District Office of the BLM is aware of the existence of the P2 team and will contact it as appropriate.

Susan Murray
644 CR 216
Dgo, 81303

3-18-01

rec'd 3/19/01

Dear Mr. Englishman,

I'm writing this in response to the BLM Draft EIS. Although I am not a geohydrologist, I do have science degrees and feel that this EIS is highly impartial. The initial chapters appear to be bias toward the Oil and Gas Industry and slant comments toward further drilling and infill. My understanding of any scientific document is that it MUST be impartial, or viewed as circumspect. P-1

The portion on water quality and movement appears to be less bias, sticking with some available studies. (There does seem to be some missing information about local water migrations in the North Valley, though.) Compiling all available information from the industry, locals and government bodies seems to be impossible. But until we can do so, I think there will large information gaps resulting in some poor choices.

Wading my way through this portion on ground water, (which is an exceedingly difficult task complicated by jargon) I've become more concerned about this most valuable resource of ours. Water is THE ultimate resource for survival. I worry that mineral rights appear to have priority over water and surface rights. I live in the Sunnyside/ Bondad area which historically has had many wells lacking mechanical integrity. Well water in the area has been grossly contaminated with thermogenic gas. People in my neighborhood have been warned not to smoke in the shower... Funny, but not amusing for those of us who live here. This direct correlation between gas wells and methane contamination has led to some remediation. But, the remediation was prompted not by good neighbor relations between gas companies and those affected, but prompted by force and the threat of litigation. These folks are not motivated in any way except by financial means. Further drilling which may be prompted by the results of this study WILL impact our water. P-2

Methane reports and complaints are increasing as people become more educated and knowledgeable about the possibility of losing groundwater quality and quantity. Natural fractures and faults throughout the area's geologic formations tend to move gasses and fluids around Although the Fruitland Formation is technically and probably a mostly closed system, evidence of the water table dropping worries me. There is evidence (not in this study) of migration of thermagenic gasses, along with upper water table changes in the upper Animas Valley. (Population stresses on the H_2O notwithstanding...) Changes of water table in the western part of the formation will eventually effect us, our semi arid environment cannot easily refill aquifers. A 'mostly closed system' doesn't engender confidence for those of us using upper level groundwater for our survival. Gravity works. P-3

Correlating the BLM EIS with Oil and Gas studies doesn't make the science any stronger. It makes it highly suspect. References to informational correlation concerns me as the P-4

industries' focus is the bottom line, no matter how many well-meaning people they hire. (Research some of Wyomings' water troubles in relation to drilling..)The BLM should be focusing on the probability of damaging our most precious resource. This document appears to dodge any correlation between the Oil and Gas Industries' drilling and the quantity and quality of our water. Some of the ground work has begun . Using this as a draft, a realistic and comprehensive analysis of oil and gas drilling affecting water quality needs to be done. As a government agency representing the people, I believe that this EIS needs to primarily focus on the future well-being of the rural population, not on the oil industries' financial pocketbook. P-4 (cont)

Thanks for your attention to this matter.

Sincerely,

Susan Murray

Responses to Comment "P" from Susan Murray, Individual

P1 The DEIS analyzes, as a minimum, continuation of current permitted drilling and other drilling and infill drilling Alternatives because these are legally permissible activities that will occur in some manner and degree on the Southern Ute Indian Reservation under existing oil and gas leases. The Alternatives follow NEPA guidelines and reflect management strategies that address the tribe's goal to develop and manage its resources for the benefit of tribal members.

P2 The BLM and BIA believe that the risk of new CBM wells contaminating drinking water sources in the Study Area is extremely small. In most cases of thermogenic methane contamination in shallow, domestic-water wells, the offending gas well has been an old, poorly constructed, conventional gas well. Many older wells did not have casing cemented to surface, so gas could migrate up the outside of the casing and then into the shallow aquifer system. All newer wells must be cemented to surface. This practice blocks the connection between the producing formation and overlying shallow aquifers and significantly reduces the potential for new wells to contaminate the shallow groundwater with methane.

The BLM and the COGCC require operators to inspect the bradenhead pressures of their wells annually. This practice helps identify potential sources of methane contamination, and the operators are required to remediate any mechanical issues immediately. This monitoring and remediation process provides for additional protection measures for shallow aquifers.

P3 The Fruitland Formation has sustained enormous pressures over the millennia because it is a confined aquifer system. There have been hundreds of wells drilled in the Fruitland Formation in Colorado. None of these wells has reported a nonartesian water level. This means that the Fruitland Formation is truly confined, not a "mostly closed system."

Decreasing water levels in shallow aquifers can be linked to changes in land use. As more and more shallow domestic wells are drilled, the depletion of the shallow aquifers is accelerated. As more irrigated, agricultural land is converted to subdivisions, a major source of recharge is removed from the system. The effect will be overdrafting the shallow aquifers, with associated decreases in the water table.

As noted above, the Fruitland Formation has excess or artesian pressures maintained by the overlying Kirtland Shale and the underlying Lewis Shale. In other words, these shales effectively separate the underground water systems. The water levels in the shallow aquifer are independent of what is occurring in the Fruitland Formation.

Fractures in the Cretaceous rocks are ubiquitous. These fractures do not form a continuous network, however, where fluids can migrate thousands of feet vertically in an efficient manner. Evidence for this is the artesian pressure in the Fruitland Formation.

If fractures were an effective route for water and/or gas to migrate, there would be no artesian

pressure in the Fruitland Formation, and the gas resource would be significantly less. Faults in the Upper Cretaceous rocks are extremely rare in the San Juan Basin. Quite often faults that are evident in the Mesaverde Formation do not extend up into the Fruitland Formation or Kirtland shale. To date, no faults have been identified that could be a route for water and/or gas to migrate into or out of the Fruitland Formation.

P4 Section 4.5 presents the effects of CBM gas development on surface and groundwater. Mitigation measures developed to protect water are described in Section 4.5.1.8.

bp

David R. Brown
Environmental Specialist

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San Juan Business Unit, HSE
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Telephone: 303-830-3241
Facsimile: 303-830-3292

March 20, 2001

Mr. Walt Brown
Bureau Of Land Management
San Juan Field Office
15 Burnett Court
Durango, Colorado 81301

RE: Comments on Oil and Gas Development On the Southern Ute Indian Reservation Environmental Impact Statement

BP is in receipt of the draft environmental impact statement (EIS). BP has hundreds of wells and holds substantial leasehold acreage within the boundaries of the Southern Ute Indian Reservation. The EIS will have a direct affect on the ability to develop natural gas resources that are critical to the Southern Ute Indian Tribe and to the nation. We appreciate the opportunity to submit comments on the DEIS.

Overall, the DEIS is well written and provides a thorough analysis of oil and gas development within the Southern Ute Indian Reservation. We do, however, have some comments, which are provided below by subject and page number. Any suggested language changes are shown in italics.

Executive Summary

Page 3

1) Reference is made to the potential for drillng up to 70 injection wells for purposes of reservoir stimulation (floods) with CO2, N, or "other fluids". While it is good that the fluid types have been left open, it is not clear that matrix stimulation of producing wells will be specifically allowed. The injection of fluids into producing wells, not only wells drilled for purposes of injection and reservoir flooding only, should also be included in the FEIS. Q-1

Page 4

1) Paragraph 3 speaks to the linkage of coal fires and seeps to production activities. However, the sections which follow in the body of the report speak to isolation of the near-outcrop rock environment from producing reservoir present in the deeper portions of the basin. This appears to be an inconsistency. As such, paragraph 3 should be modified to more accurately reflect the formation - outcrop discontinuity which is described in paragraphs found on pages 3-65 and 3-66. It should perhaps also be noted that causative linkage of coal fires at outcrop to down-dip production can only be postulated if the producing wells are located within 0.5 to 1.0 miles of the outcrop. At the present time, the COGCC does not presently approve drilling in this area. Q-2

Page 8

1) The 3-M study is described here as being focused on " mapping, modeling and mitigating". This is not correct: 3-M refers to mapping, modeling, and *monitoring*. It is recommended these changes be made to the FEIS. Q-3

2) Reference to the link between coal fires and production is made again here and should be clarified as noted above. Q-4

3) Reference is made to the mapping and modeling aspects of the 3-M study. It is implied that this work is not yet done when in fact the mapping and modeling aspects of the study, as originally envisioned, have been completed and reported and should be cited in the FEIS. Q-5

Air Quality

BP believes that the BLM has performed an excellent analysis in attempting to quantify air quality impacts from the proposed action. These comments are intended to suggest areas where the BLM needs clarification of their analysis. They are not intended to suggest that the BLM perform any additional analyses prior to issuing a final document. Further, these comments are intended to expand what the BLM has already presented regarding the conservative nature of this analysis. BP believes it is important for the decision maker to understand the level of conservatism in this analysis and that this be considered in issuing a ROD for this EIS.

Page 3-3

1) A reference should be provided for the EPA 1990 MM4 modeling that was used as input to CALMET. Q-6
2) 3.2.4 Existing Air Quality; the first bullet item should be changed to read: "Exhaust emissions (primarily Carbon Monoxide (CO) and oxides of nitrogen (NOx) from existing *natural gas fired* compressor engines used in the production Q-7

of natural gas; *gasoline and diesel* vehicle tailpipe emissions of combustion pollutants (*VOC*, CO, NOx, particulate matter less than ten microns in effective diameter (PM_{10}) and sulfur dioxide (SO_2)." Q-7 (cont)

<u>Page 3-4</u>

1) Another bullet item should be added to address the transport of pollutants from outside the region into the region. Such transport might be the most significant source of air contaminants in the study area. Q-8
2) The third paragraph should be changed to read: "The maximum *measured* pollutant concentrations …" Q-9

<u>Page 3-6</u>
<u>Table 3-1 Measured Concentrations of Regulated Air Pollutants at the SUIT Monitoring Station near Ignacio, Colorado</u>

1) It is suggested that 24-hour PM_{10} concentrations be added to the table for the years 1992 through 1996. If this data is not available, this should be noted. Q-10

<u>Page 3-7 Regulatory Framework</u>

1) In the second paragraph, a discussion of the EPA Part 71 Major Source Permitting Program should be added (Title V on Tribal Land). The EPA has been issuing such permits for the past year. These permits are being required even if the State of Colorado has issued a Part 70 Permit. Q-11
2) In the last paragraph, there is a discussion of the EPA proposed O_3 and $PM_{2.5}$ standards. This discussion needs to be revised, because the EPA has rescinded these standards pending the outcome of a legal challenge. Further, if the Court upholds the standards, the EPA can immediately enforce them. However, enforcement by the State or the Tribe would be delayed until a SIP or TIP is developed. Q-12

<u>Page 3-8</u>

1) The last sentence in the first paragraph is confusing with respect to future pollutant sources and NSR. This sentence should be modified to clarify these terms. Under the CAA, NSR and PSD applies only to those sources for which a permit application has been developed regarding a cumulative analysis. Sources that have not had final engineering developed should not be included in an NSR cumulative air quality analysis, nor should sources that were included in an EIS. Q-13
2) In the second paragraph, it is suggested that the word "exceeded" rather than "violated" be used with respect to NO_2 increment. Q-14
3) In the fifth paragraph, NO_2, PM_{10} and SO_2 should be subscripted. Q-15

<u>Page 4-7 Air Quality and Climate</u>

1) BP agrees with the conclusion the BLM reached that "No significant impacts to climate are anticipated from the implementation of the Proposed Actions or

Alternatives". However, no analysis was performed to support this statement. By this comment, BP is not suggesting that such an analysis be performed, but rather that additional language should be added to support this position. BP suggests the first sentence in the fifth paragraph be changed to read, "The air quality assessment was based on the best available engineering data and assumptions, meteorology data, and EPA dispersion modeling procedures, *as well as professional and scientific judgment*". Q-16

Page 4-8

1) In the first paragraph, the sentence that states "Air quality regulations require proposed new, or modified sources (including nitrogen compressors and gas compression facilities) undergo a permit review before construction can begin" is not completely accurate. This is because on Tribal land there is no minor source-permitting program. It is recommended that this paragraph be modified to address this issue but with emphasis on the pending program the Tribe will be implementing with support of the Colorado Air Quality Division. Q-17
2) In the third paragraph, it is recommended that language be added regarding the manner in which the EPA establishes the concentration levels and averaging time for the NAAQS. These standards are promulgated to protect the most sensitive portion of the public. Q-18

Page 4-10

1) The fifth paragraph should provide the duration of the construction activities. Also, in this paragraph the SO_2 contribution from the drilling engine to the three-hour model prediction versus background data should be provided. Q-19
2) The sixth paragraph compares construction-modeled impacts to the NAAQS and Colorado AAQS. In reality, since all construction activities are to occur on Tribal land, Colorado AAQS are not applicable. Q-20

Page 4-11

1) The fourth paragraph should be modified as follows: Q-21
"The lowest emission rate represents compression engines using emerging technology which would be more difficult to guarantee during the LOP. *All of the emission cases considered are utilizing engines that have significant reductions in NOx emissions compared to uncontrolled engines.* The maximum potential near field NO_2 concentrations were determined by multiplying maximum predicted NOx concentrations by 0.75, in accordance with EPA methodology 40 CFR 51, Appendix W, Section 6.2.3."
2) In the fourth paragraph, it should be noted that the stated emission levels are only applicable to compressor engines having a site-rated capacity of greater than 500 hp-hr. Q-22

3) The sixth paragraph is confusing with respect to what sources are contributing to the modeled impacts that are being compared to the PSD increment. Does this represent only Proposed Action Sources or some other subset of sources? Q-23

Page 4-12

1) The second paragraph should be modified to read: "When this value is added to the assumed representative background concentration (15 ug/m3), the resulting predicted maximum total impact of 24 ug/m3 is also below the NO_2 NAAQS of 100 ug/m3 (annual). *It is important to note that this projected increase in NO_2 levels is only expected to occur at one location and should not be assumed to occur throughout the entire study area.*" Q-24
2) A statement should be added to the discussion of the short-term toxicity of formaldehyde noting that the scientific basis of various state standards are not known. Q-25
3) BP recommends that the sixth paragraph be revised in the following manner: "Under the MEI analysis, the maximum individual cancer risk for formaldehyde would be 2.8×10^{-6}. *This incremental risk is predicted to occur at a location where the public currently does not reside.*" Q-26

Page 4-13

It is recommended that an additional bullet be added that states: "*By using typical maintenance procedures using flue gas testing to tune compressor engines, actual emissions should be substantially below potential or maximum emissions.*" Q-27

Page 4-14

In the second paragraph, it should be noted that the Tribe currently does not have a minor source permitting program. As a result, pre-construction permits may not be necessary in all cases. This will be determined as the minor source program develops. Q-28

General Comments of Cumulative AQRV Analyses

BP believes that the visibility analysis provides technical information regarding the potential visual range effects from the Proposed Action. However, when this information is used in issuing a ROD, it is very important to also consider the very conservative nature of this analysis. BP believes that it is inappropriate to consider emission levels less than 2 g/hp-hr. The following points reinforce this position in addition to what is stated on page 4-21 of the document: Q-29

1) The visibility range analysis is based on the assumption that background levels will remain at the 90th percentile for all days of the year. Since the calculated change in visual range is directly related to this concentration level, assuming such uniform clean atmospheric conditions is very conservative. Since all visibility calculations are referenced to these ultra clean conditions, such

projections represent the extreme in potential impacts. In reality, actual impacts on any given day will likely be less than what is projected in the Draft SUIT EIS.

2) This analysis was based on the CALMET/CALPUFF Model. While this model represents a substantial improvement over previous modeling tools, it has not been sufficiently tested in the manner in which it was used in this analysis. The EPA has recently proposed that this model be included as a Guideline Model.
3) In reviewing EPA documentation associated with CALPUFF, there are a limited number of model evaluations that have been conducted. From information in the EPA Docket, it appears that the EPA evaluated the model against the Great Plains Tracer Experiment in Norman, Oklahoma and the Savannah River Laboratory Experiment. In addition, an evaluation was conducted using the INEL Tracer Test. GTI is also aware of other model data comparisons such as CAPTEX. While these model data comparisons show that to some extent the CALPUFF model can replicate the observed data, there are a number of significant limitations in these studies. Therefore, conservative results are inherent when using the model in its present form.

The CALPUFF model is the current state-of-the-art model available for performing AQRV analysis in Class I areas and was the appropriate choice of a model for this study. Despite this, we believe the model is very conservative in applications such as this EIS. There is still some uncertainty relative to nitrate levels. The importance of this uncertainty is further supported by examining measured air quality levels in relation to changes in emissions within the region. Figures 1 and 2 present measured fine particulate levels in the Mesa Verde and Weimunich Class I areas. These figures indicate that NO_3 levels have been relatively constant over the period of record. It is important to note that during this same time period NOx emissions, as a result of gas development, have substantially increased. This is indicated in Figures 1 and 2. Based on these findings, it is concluded that there may not be any relationship in these two Class I areas between emissions and NO_3 levels (and visibility). There are several possible explanations for this finding. First, the formation of NO_3 may be limited by both ambient O_3 levels, as well as ammonia. Very little research has been conducted in this area. In the CALPUFF modeling, the default background concentration of 10 ppb of ammonia was assumed. The assumption in the model is that ammonia concentration is uniform at this level for all hours of the year and uniform throughout the mixed layer.

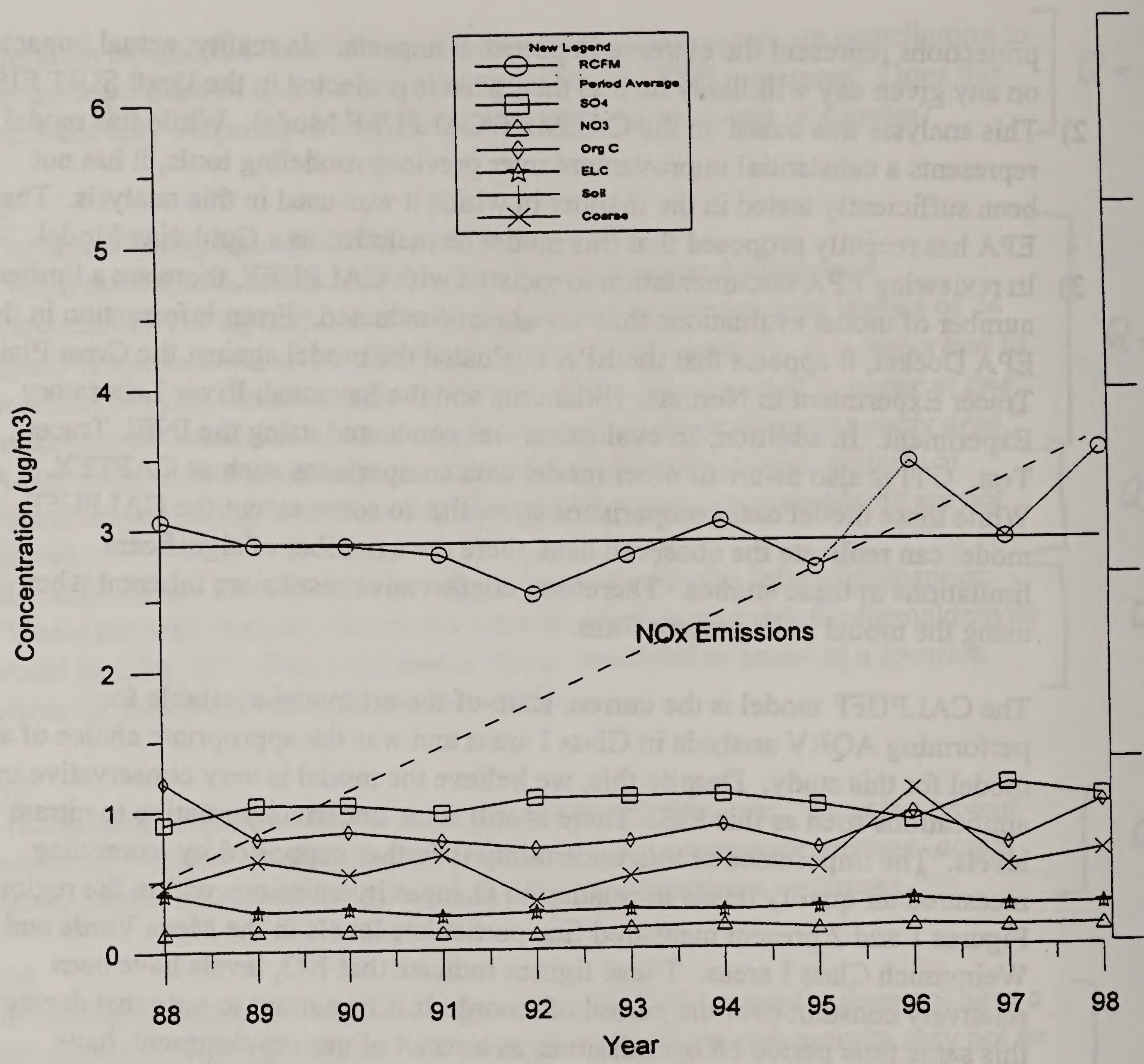

Figure 1. Plot of annual average particulate species at the Mesa Verda National Park

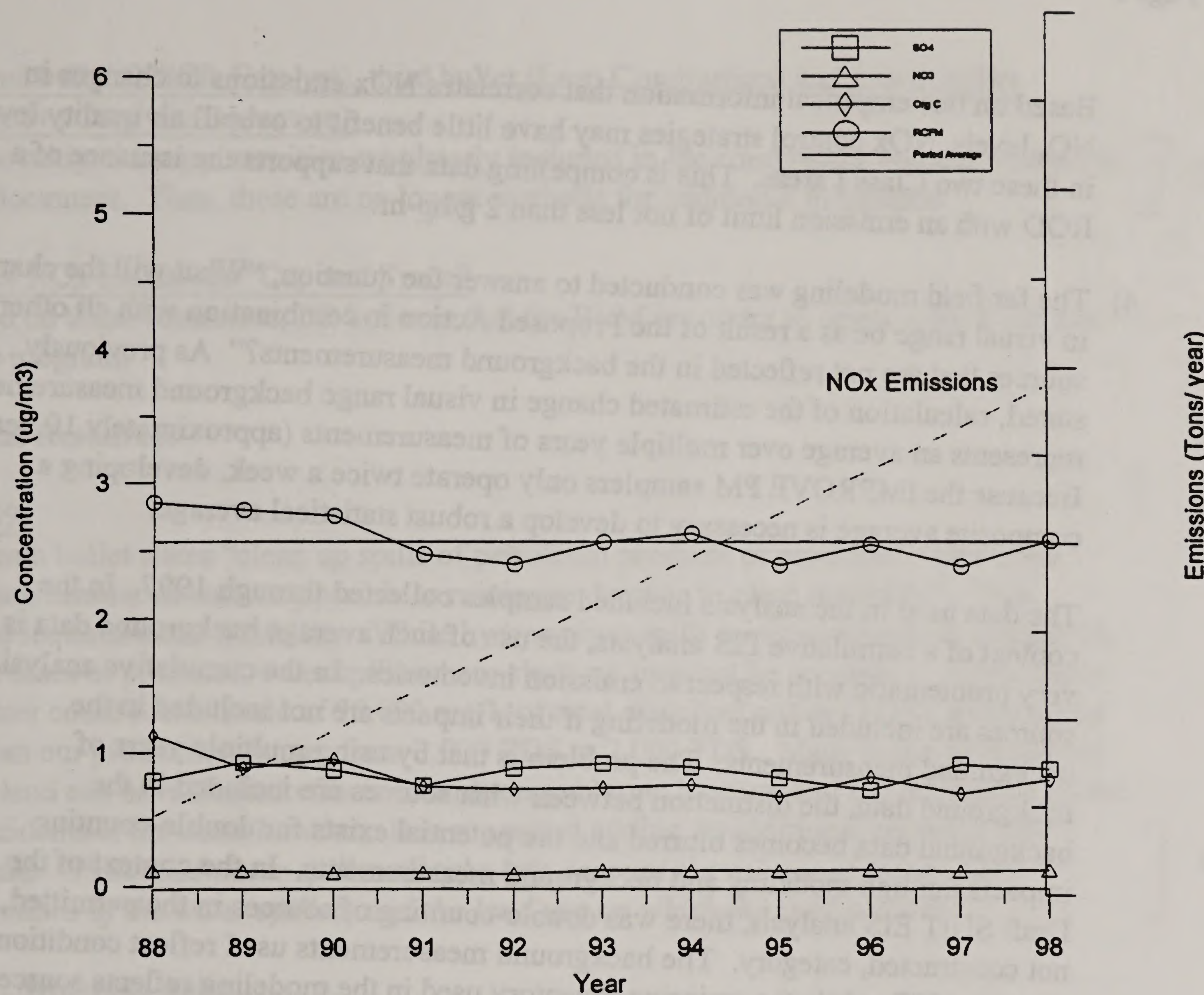

Figure 2. Plot of annual average particulate species at the Weminuche Wilderness Area

Based on this empirical information that correlates NOx emissions to changes in NO_3 levels, NOx control strategies may have little benefit to overall air quality levels in these two Class I areas. This is compelling data that supports the issuance of a ROD with an emission limit of not less than 2 g/hp-hr.

4) The far field modeling was conducted to answer the question, "What will the change in visual range be as a result of the Proposed Action in combination with all other sources that are not reflected in the background measurements?" As previously stated, calculation of the estimated change in visual range background measurements represents an average over multiple years of measurements (approximately 10 years). Because the IMPROVE PM samplers only operate twice a week, developing a composite average is necessary to develop a robust statistical average.

   The data used in the analysis included samples collected through 1997. In the context of a cumulative EIS analysis, the use of such average background data is very problematic with respect to emission inventories. In the cumulative analysis, sources are included in the modeling if their impacts are not included in the background measurements. The problem is that by using multiple years of background data, the distinction between what sources are included in the background data becomes blurred and the potential exists for double-counting impacts through modeling and background measurements. In the context of the Draft SUIT EIS analysis, there was double-counting of sources in the permitted, but not constructed, category. The background measurements used reflect conditions through 1997, while the emission inventory used in the modeling reflects sources in the permitted, but constructed, category beginning in 1995. Thus, sources that either became operational or terminated their operating permits between 1995 and 1997 have impacts that are double-counted in this analysis. The absolute magnitude of this double-counting is not known; but, based on previously presented empirical data that found no correlation between emissions to NO_3 air quality, this double-counting of emissions in the model will add to the overall conservatism.

<u>Page 4-20</u>
In the second paragraph, NOX should be NOx.] Q-32

<u>Page 4-22 Mitigation Summary</u>
<u>First bullet</u>
The installation of larger pipelines may not reduce overall field compression needs. CBM production is at substantially lower reservoir pressures than conventional production and, consequently, more compression is needed. Thus, simply increasing the size of the pipeline may not affect overall compression needs.] Q-3(

Second bullet (NSCR Catalyst), third bullet (Lean Combustion) and fourth bullet (Selective Catalytic Reduction)
These mitigation opportunities are already included in the compressor engines studied in this document. Thus, these are no longer methods for additional mitigation. Q-32

Page 4-24 NOx Emissions "Cap and Trade"
Based on these comments, BP believes that the BLM is correct to reject a NOx cap and trade program.

Biological Resources

Page 4-39:
The seventh bullet states "clean up spills of petroleum products or produced water in an appropriate manner as soon as possible to minimize damage to plant materials". This statement requires more flexibility. While hydrocarbon spills require immediate mitigation, there are cases of produced water spills where clean-up may not be necessary. While some CBM water could reach levels of 20,000 mg/L of total dissolved solids (TDS), much of the water from our production ranges from 3,000 TDS to 7,000 TDS. Many spills of produced water to land can have limited effects considering volume, location and the infrequent nature of the incidents at the same location. It is suggested adding an additional sentence that would read: "*Produced water spills will take into account the volume of water, TDS concentrations of the water spilled, and the land-use on which the spill occurred.*" Q-33

Geology, Minerals, Soils

As a general comment, ongoing studies associated with 3M and the monitoring being conducted by the SUIT is sufficient to address these concerns. In addition, the Application for Permit to Drill (APD) process provides a mechanism for site specific and case-by-case assessment of individual well sites and their impact, if any, on these resource concerns.

Water Resources

Page 3-40
The discussions of the Kirtland and Tertiary formations need to include the occurrence of thin, discontinuous coals. The use of mud and density logs to identify coals in the Fruitland formation has shown thin, discontinuous coals and gas kicks within tertiary formations. Q-34

Page 3-55
Map 15 presents all water well locations and other information presumably based on records of the State Engineer's Office (SEO). The SEO records are permits only. They may or may not have been drilled and there could be wells that are not recorded. It is important that the FEIS indicate that some limitations exist with SEO records. Q-35

Pages 3-55 and 3-56
There are several other papers, which would add support to the section. "Hydrogeology of the Animas Valley", Paul Oldaker, 1992, Kernoudle, *et al.* (referred to later), are papers on each unit in the basin. Brogden, *et al.*, 1976 (referred to later) is the first data for the reservation. Stone, *et al.*, 1976 (New Mexico Bureau of Mines) is probably the most complete data compilation in the basin. These may have been used, but we would suggest they be referenced in the bibliography. Q-36

Page 3-56
Paragraph 1 describes that pre-Cretaceous rocks contain waters with salinities too high to be used as aquifers. Note that the Fruitland is Cretaceous and that this wording implies Fruitland waters could be used as aquifer waters. This paragraph should be revised to stipulate that rocks older than the Animas Formation contain waters which are generally too saline to be considered as principal aquifers - the notable potential exceptions being where they are within 0.5 to 1.0 miles of outcrop. Q-37

Table 3-14
The tertiary formations and the Picture Cliffs sandstone are identified as having a calcium-bicarbonate type. For the tertiary formations, this is true near the surface where an oxidized system is in place. However, deeper depths will go to a sodium-bicarbonate type. Generally, the Picture Cliffs sandstone is a sodium-chloride or sodium-bicarbonate type. It is suggested this change be made to the FEIS. Q-38

Page 3-64
Water produced from Cretaceous formations has yielded high TDS water, but also has yielded low TDS water near the outcrops. This should be mentioned in the FEIS. Q-39

Page 3-65
1) A 1991 paper by Mr. Paul Oldaker is referred in the first full paragraph. Mr. Oldaker also compiled much of this information in a 1987 report to Amoco. It is recommended that Mr. Oldaker's report to Amoco in 1887 be referenced in addition to the 1991 paper. Q-40

2) The closing line of paragraph 1 describes that the 3-M study will model the hydrology of the Fruitland. This work has already been done by Applied Hydrology Associates, was made publicly available in December of 2000, and should be referred to as being complete in the FEIS. Q-41

COMMENT Q

Page 3-67
There appear to be two earlier reports on isotopes that should be included. One is Mr. Dudley Rice's report on the Reservation for the BIA which was authored in 1987. In addition, a USGS report authored by Chafin in 1995 should also be referenced. Q-42

Page 3-71
In Table 3-16, flows should be reported in cubic feet per second and barrels per day, since all three units are used. Q-43

Page 3-74
The historical gas and oil seepage in the basin show that "baseline" hydrocarbon concentrations in surface water may have been significant. These should be included in the historical water quality discussion of the area. Q-44

Page 4-115
The second bullet on this page refers to carbon isotopic analysis where methane in water is greater than 1 mg/L. It should be noted that the infill order raised this threshold to 2.0 mg/L due to concerns about whether enough gas would be present in a sample containing 1.0 mg/L to perform isotopic analysis. It is recommended that this threshold be incorporated into the FEIS to be consistent with the infill order issued by the Colorado Oil and Gas Commission. Q-45

Surface Water

Page 4-127
A reference is made to Section 404 of the Clean Water Act for activities crossing surface waters. A reference should also be made to Section 401 certification for activities crossing surface waters within the boundaries of the Southern Ute Indian Reservation. Q-46

Page 4-128
The first bullet item on this page refers to reclaiming roads not necessary and completing revegetation. It should be emphasized that the Tribe directs any reclamation. Consequently, it is suggested that the phrase, "*As directed by the SUIT*, reclaiming roads......" be inserted into this mitigation item. Q-47

Page 4-128
The sixth bullet refers to routine inspections of facilities, pipelines, and well sites to determine erosion problems, sedimentation, spills, or leaks that require corrective action. It should be pointed out that if proposed facilities exceed more than five acres, regular inspections are required under stormwater management plans that must be developed for that project. It is suggested that the stormwater regulations be incorporated by reference as the basis for this requirement. Q-48

Page 4-128
The seventh bullet refers to "all flow and injection lines would be removed and any buried transmission lines would remain in place" in reference to non-productive wells. It is recommended that the reference to "removing all flow and injection lines" be worded with more flexibility. Leaving these lines in place after abandonment is not considered a safety or environmental hazard and would eliminate surface disturbance that is necessary for removing the lines. We would recommend that the phrase be re-worded to state: "*All flow lines, injection lines and transmission lines would remain in place unless conditions dictate the removal of such lines as directed by the Southern Ute Indian Tribe.*" Q-49

Land Use and Ownership

As a general comment, it should be noted that both private and Tribal lands within the study area are subject to environmental review processes. Fee land activities are regulated both by the County and the Colorado Oil and Gas Commission. On Tribal lands, the Tribe, the BIA and the BLM work concurrently on evaluating proposed oil and gas activities. Coupled with the mitigation presented in this category and the oversight by the number of agencies, depending upon land ownership, a program is in place to thoroughly evaluate environmental affects of project proposals.

Cultural Resources

We concur with the findings presented in the mitigation portion of the analysis. Avoidance of cultural sites, identified as part of the field surveys on Tribal lands, has been applied over the years and has been very successful in minimizing impacts.

Thank you for considering our comments.

Sincerely,

Dave Brown
Environmental Specialist

Responses to Comment "Q" from David R. Brown, Amoco Production Company/BP

Q1 Injection of fluids into producing wells for matrix stimulation is addressed in Section 2.8.5.1. In addition, Sections 4.4 and 4.5 discuss stimulation of producing wells.

Q2 The 3M study concluded that a regional discontinuity between the Fruitland formation in the center of the San Juan Basin and the outcrop of the Fruitland formation is not required in order to obtain a match between historical data sets. A local discontinuity may be present in the Valencia Canyon area.

Q3 The recommended change has been made globally in the FEIS.

Q4 See response to comment Q-2.

Q5 The FEIS has been revised to reflect the current status of the 3M Study. The three Ms in the 3M Project stand for Mapping, Modeling, and Monitoring. The Colorado Geological Society open-file report on the Mapping was issued in July, 2000. The Modeling studies prepared with BLM, SUIT, and COGCC oversight were issued in January 2001. The Monitoring of soil vapor tubes and monitor wells by the BLM, SUIT, and COGCC is ongoing. Additional monitoring locations will be constructed over the next several years.

Q6 As described in the "Air Quality Impact Assessment Technical Support Document" (Earth Tech 2000): "The MM4 data set of 1990 was prepared by the EPA for use in modeling studies, to supplement observations in data sparse areas (NCDC, 1995)," including the complete technical reference "National Climatic Data Center (NCDC), 1995. MM4 - 1990 Meteorology Data, Federal Building, 151 Patton Avenue, Asheville, NC 28801-5001."

Q7 These changes will be incorporated into the Final EIS.

Q8 The following sentence has been added to the Final EIS:

"■ transport of air pollutants from emission sources located outside the Reservation."

Q9 As previously stated in the DEIS (page 3-4; Chapter 3; 3.2 AIR QUALITY AND METEOROLOGY; 3.2.4 <u>Existing Air Quality</u>): "The maximum pollutant concentrations recorded at Ignacio are well below applicable National Ambient Air Quality Standards (NAAQS) for most pollutants, although hourly concentrations of ozone approaching the federal standard

have been observed occasionally."

However, Table 3-1 (page 3-6; Measured Concentrations of Regulated Air Pollutants at the SUIT Monitoring Station near Ignacio (in $\mu g/m^3$)) includes both short- and long-term average data, therefore the recommended change in the third paragraph is not appropriate.

Q10 Table 3-1 (Measured Concentrations of Regulated Air Pollutants at the SUIT Monitoring Station near Ignacio (in $\mu g/m^3$) has been revised to include the most recent data available. PM_{10} data, however, are not available after 1996.

Q11 The following sentence will be appended to the second paragraph:

"Recently, EPA Region 8 began issuing Major Source Permits for sources located on tribal lands regardless of previous permitting by the CDPHE-APCD."

Q12 On February 27, 2001, the Supreme Court upheld EPA's authority to set new 8-hour ozone and fine particulate matter ($PM_{2.5}$) ambient air quality standards, stating that the Clean Air Act "unambiguously bars cost considerations" when EPA sets air quality standards, but that EPA can consider costs when directing the applicable air quality regulatory agencies on how to implement the new standards. The Court further directed EPA to revise its previously proposed methods to implement these new ambient air quality standards, but the statements in the DEIS are correct. Therefore, no revision is necessary in the Final EIS.

Q13 The referenced sentence will be revised as follows: "Finally, an analysis of cumulative impacts due to all existing sources, and the permit applicant's sources, is also required to demonstrate that applicable ambient air quality standards will be complied with during the operational lifetime of the permit applicant's operations."

Q14 Although "exceeded" may describe the situation better, "violated" and "violation" are direct quotes from the referenced document. Therefore, no revision is necessary in the Final EIS.

Q15 These changes will be incorporated into the Final EIS.

Q16 These changes will be incorporated into the Final EIS.

Q17 As stated, the sentence indicates that the Clean Air Act requires that new proposed, or modified, air pollutant emission sources undergo a permit *review* before construction begins.

This does not mean to imply all sources (regardless of size or type) must *obtain* a permit before construction begins. The review may determine that a proposed source would emit air pollutants below an established *de minimis* level, therefore no further permitting would be required.

With respect to emission sources on tribal land, the EPA is responsible for regulating air pollutant emissions until such time that EPA formally delegates that responsibility to a recognized tribal air regulatory authority through an approved Tribal Implementation Plan. Therefore, no revision is necessary in the Final EIS.

Please also see Comment Response Q28.

Q18 Please see Comment Response H2.

Q19 The referenced sentence will be revised as follows:

> These SO_2 emissions would be temporary, occurring only during the limited 36-day construction period at each well location. The maximum modeled concentrations (including representative background values of 57 and 23 $\mu g/m^3$, respectively) would be nearly 702 $\mu g/m^3$ (3-hour) and 133 $\mu g/m^3$ (24-hour).

Q20 As described in the DEIS (page 4-8; 4.2 AIR QUALITY AND CLIMATE; 4.2.1 Issues, Impact Types, and Criteria):

> This analysis was prepared solely under the requirements of NEPA, in order to assess and disclose reasonably foreseeable impacts to both the public and the Bureau decisionmaker before a Record of Decision is issued. Due to the preliminary nature of the programmatic NEPA analysis, it should be considered a "reasonable, but conservative" upper estimate of predicted impacts. Actual impacts at the time of development (subject to air pollutant emission source permitting) are likely to be less.

Given this "programmatic" nature, specific source locations are not known. Since it is possible that an actual source could be situated just within the tribal boundary, the predicted impacts could occur outside the Reservation, and comparison to Colorado Ambient Air Quality Standard is appropriate. Therefore, no revision is necessary in the Final EIS.

Q21 As stated in the DEIS (page 4-11; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery):

> Maximum direct NO_2 impacts during operations were predicted based on assumed NO_x emissions from reasonably foreseeable CBM recovery wells, injector well

> and pipelines compressor engines. However, given the uncertain and preliminary nature of potential development, three different NO_x emissions rates were used: 1.0 grams per horsepower-hour (g/hp-hr; which reflects currently available, clean burning equipment), 1.5 g/hp-hr (which reflects recently permitted equipment), and 2.0 g/hp-hr (which reflects historically permitted equipment). The highest emission rate represents compression engines using proven technology which would ensure this level of control could be continuously achieved. The lowest emission rate represents compression engines using emerging technology which would be more difficult to guarantee throughout the LOP.

The use of compressor engines with uncontrolled NO_x emissions is simply not reasonably foreseeable, therefore, no revision is necessary in the Final EIS.

Q22 As stated in the "Air Quality Impact Assessment Technical Support Document" (page 30; Dames and Moore 2000):

> Table 6-1 presents NO_x, CO and formaldehyde emissions data for Alternative 3. This table represents the maximum level of development and presents emissions for the three compressor engine NO_x emission scenarios considered in this analysis (1.0, 1.5 and 2.0 g/hp-hr). These emission rates reflect potential emissions. It has been shown that the use of a maintenance program to routinely verify proper engine tuning will result in substantially lower emissions.
>
> It should be noted that the assumed level of NO_x control cannot be achieved on all sizes of engines. At the present time, it is difficult to achieve this level of NO_x control on engines of less than 500 horsepower output.

In developing the air quality impact assessment, we determined that assuming a minimum compressor size of 500 horsepower is reasonably foreseeable. Therefore, no revision is necessary in the Final EIS.

Q23 The comparisons of predicted air quality impacts presented on pages 4-11 through 4-12 of the DEIS (Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 <u>Alternative 3 - Enhanced Coalbed Methane Recovery</u>) to the PSD Class II increments are for that Alternative's sources alone. The comparisons of predicted air quality impacts presented on pages 4-14 through 4-16 of the DEIS (Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.7 <u>Cumulative Impacts</u>) to the PSD Class I increments are for that Alternative's and other existing or reasonably foreseeable sources combined.

It should be noted, however, that these comparisons are *not*, in any way, intended to be complete regulatory PSD Increment Consumption Analyses, but simply assessments indicating the increment would not be exceeded by either the maximum direct emission sources alone, or the total cumulative emission sources combined. Many of the potential air pollutant emission

sources were analyzed at their maximum assumed emission levels; actual emissions and their related air quality impacts are typically less. In addition, the analysis did not attempt to determine which of the cumulative sources are legally subject to the PSD increment-consumption regulations. At the time of a preconstruction air quality permit application review, the applicable air quality regulatory agencies may require a much more detailed PSD Increment Consumption Analyses.

Q24 The following "reasonable, but conservative" assumption listed on page 4-13 of the DEIS (Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery) sentence will be changed as follows:

- Maximum measured background criteria air pollutant concentrations were assumed to occur at all locations in the region throughout the LOP. In addition, the maximum predicted air quality impacts would occur only in the vicinity of the anticipated emission sources. Actual impacts would be less further away from the predicted points of maximum.

Q25 As stated in the DEIS (page 4-12; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery): "Since neither the CDPHE-APCD nor EPA have established HAP standards [including formaldehyde], predicted 8-hour HAP concentrations were compared to a range of 8-hour state maximum Acceptable Ambient Concentration Levels (AACL; EPA 1997a)."

The state's AACL's were gathered by the National Air Toxics Information Clearinghouse (NATICH) in 1997. NATICH was an information service offered by the EPA, in conjunction with the State and Territorial Air Pollution Program Administrators (STAPPA) and the Association of Local Air Pollution Control Officials (ALAPCO) organizations, to collect, classify, and disseminate toxic-air-pollutant information submitted by state and local air regulatory agencies. Although EPA has replaced NATICH with the Technical Air Toxics Website (www.epa.gov/ttn/atw/index.html), EPA no longer maintains the 8-hour state AACL lists.

Q26 As stated in the DEIS (page 4-12; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery): "The maximum formaldehyde concentration was predicted to occur at 320 m (less then one-quarter mile) adjacent to a compressor station; as the distance from the emission source increases, the predicted concentrations decrease rapidly."

Given this "programmatic" nature of the air quality impact assessment, specific source and receptor (residence) locations are not known. However, based on the "reasonable, but conservative" analysis assumptions applied, any residences ultimately located within 320 m of a compressor station could experience these maximum potential formaldehyde impacts. Therefore,

no revision is necessary in the Final EIS.

Q27 As referenced in Comment Response Q21, given the uncertain and preliminary nature of potential development, three different NO_x compressor-engine emissions rates were used: one reflecting historically permitted equipment; one reflecting recently permitted equipment; and a third reflecting currently available, clean-burning equipment. The highest emission rate represents compression engines using proven technology that would ensure this level of control could be continuously achieved. The lowest emission rate represents compression engines using emerging technology that would be more difficult to guarantee throughout the LOP. "Using typical maintenance procedures using flue gas testing to tune compressor engines" would indeed lower potential emissions. However, the use of flue gas testing to tune compressor engines continually throughout the 20-year life of project (LOP) is simply not reasonably foreseeable. Therefore, no revision is necessary in the Final EIS.

Q28 As stated in the DEIS (page 3-7; Chapter 3; 3.2 AIR QUALITY AND METEOROLOGY; 3.2.5 Regulatory Framework):

> The Clean Air Act directs the EPA to promulgate the Tribal Authority Rule, establishing tribal jurisdiction over air emission sources on both trust and fee lands within the exterior boundaries of Indian reservations. Pursuant to this rule, the SUIT has submitted a "Treatment as a State" application to the EPA. This application requests the EPA treat the SUIT in the same manner as a state for the purposes of Clean Air Act Section 105 grants and to formally recognize the SUIT as an affected state when permits are written for sources within 50 miles of the Reservation boundaries (per 40 CFR 70.8 and 71.2). Affected state status would allow the SUIT to review these permits and supply comments to applicable air quality regulatory agencies which have emission source authority.
>
> As a result of the Tribal Authority Rule, the SUIT has the option to develop an Operating Permits Program under Title V of the Clean Air Act. A delegation of authority would allow the SUIT to write permits for air pollutant emission sources located within the Reservation boundary, including sources located on fee land. At the present time, this program is in the developmental stages and an evaluation has shown that such a program is economically feasible. The CDPHE-APCD has also claimed jurisdiction over air emission sources on fee land within the Reservation exterior boundary, and has issued some air pollutant emissions permits, but has not received formal Title V permitting authority from EPA for these sources. In late 1999, the SUIT and the CDPHE-APCD signed an agreement to jointly develop an air quality program for the Reservation. The agreement specifies formation of a joint tribal-state commission, but details of the program are under development. The EPA has expressed an intent to support the joint program. However, if the EPA does not authorize a delegated authority plan, then EPA is obligated to limit emissions from air pollutant emission sources

located within the Reservation through a formal Federal Implementation Plan.

For several years before 1998 (at which time EPA issued the Tribal Authority Rule allowing tribes to be treated in the same manner as states for purposes of administering some Clean Air Act programs), CDPHE-APCD had issued permits to nontribal air pollution sources located on fee land. The EPA had (and continues to have) authority to regulate tribal air pollutant emission sources.

The State of Colorado and the Southern Ute Indian Tribe signed their historic agreement in December, 1999, to establish a joint Tribal/State Commission to set standards for the air quality program and rules and regulations pertaining to all land within the exterior boundaries of the Reservation. The Commission would be composed of three members appointed by the tribe and three members appointed by the Governor. Additionally, the tribe would receive authority from the EPA to administer air regulatory programs under the Clean Air Act. Because of the unique, intergovernmental nature of this program, both the tribe and the Colorado General Assembly enacted legislation last year (2000) to create the Commission and implement the Agreement. However, requisite Federal legislation must be in place by December 2001, or the agreement automatically terminates.

Until EPA delegates authority to SUIT under the Clean Air Act to issue permits for air pollutant emission sources located within the Reservation boundary, the Respondent is correct that "the Tribe currently does not have a minor source permitting program."

Q29 You have cited several reasons why the air quality impacts predicted in the DEIS represent an upper estimate of potential air quality impacts that is unlikely actually to be reached, based on "reasonable, but conservative" analysis assumptions.

As stated in the DEIS (page 4-7; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.1 Issues, Impact Types, and Criteria):

> Potential air quality impacts from potential CBM development were analyzed and reported in Section 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery and in Section 4.2.7 Cumulative Impacts. This analysis was prepared solely under the requirements of NEPA, in order to assess and disclose reasonably foreseeable impacts to both the public and the Bureau decisionmaker before a Record of Decision is issued. Due to the preliminary nature of the programmatic NEPA analysis, it should be considered a "reasonable, but conservative" upper estimate of predicted impacts. Actual impacts at the time of development (subject to air pollutant emission source permitting) are likely to be less.

In addition, the visibility-impact assessment has been revised, as described in Comment Response A2. Regarding the basis for analyzing three different compressor engine NO_x emissions rate scenarios, please also see Comment Response A1.

The Respondent should contact the applicable air quality regulatory agency directly, to request that nitrogen injectors and gas compression facilities not be permitted at an emission rate less than 2.0 g/hp-hr.

Q30 The entire visibility impact analysis has been revised in the Final EIS.

Q31 The referenced sentence will be revised as follows:

"■ Reduce Compression Requirements. This would reduce the need for overall LOP compression by limiting the need for injection and pipeline compressors."

Q32 The fifth sentence in the second paragraph of Section 4.2.8 Mitigation Summary (DEIS page 4-22) will be revised as follows: "A variety of potential emission reduction measures (BLM 1999) are available to limit NO_x and other pollutant emissions."

Q33 No change has been made to the text in this section. Produced water spill remediation would be handled on a case-by-case basis.

Q34 We are not aware of any peer-reviewed, published literature that identifies coals in the Upper Kirtland Shale or the shallower Tertiary formations. There are reports of thin, lenticular coals in the lower Kirtland Shale. There are also reports of nonassociated gas produced from the Tertiary Nacimiento Formation. This gas has been identified as having an origin from deeper, kerogen-rich source rocks, such as the Fruitland Formation.

Q35 We agree. The FEIS includes language describing the limitations of the water wells records. Water wells shown on Figure 15 have been permitted by the State Engineers Office. Although nearly all these wells have presumably been drilled, some may not have been installed. There are also an unknown number of unpermitted shallow water wells in the Study Area.

Q36 Although these papers contain relevant information, their indirect role in the development of the EIS does not warrant a reference.

Q37 Fruitland formation water quality is sufficient, in some locations, to make it a usable source for drinking water and livestock watering at distances farther than 0.5 to 1.0 miles from the outcrop. No EIS changes are necessary.

Q38 We did not modify the FEIS in response to this comment, because the suggested change

would not affect the impact analysis.

Q39 You have identified an error in the text of the DEIS. We have modified the text of the FEIS to reflect the data in Table 3-14, which accurately displays the TDS ranges for the Cretaceous formations within the Study Area.

Q40 Please see Comment Response Q36.

Q41 Agree. At the time the draft was issued, the modeling reports were not yet completed. Now that these reports have been issued, the references will be updated to show the that work is finished.

Q42 Please see Comment Response Q36.

Q43 Average annual runoff in a watershed is, by convention, expressed in acre-feet of water. River discharge, measured at a gauging station, is expressed in cubic feet per second. This section is consistent with convention.

Q44 The text notes that there is a lack of information to determine baseline levels of hydrocarbons in surface water. While published and anecdotal accounts of gas seeps in the Pine River and Texas Creek (outside the Study Area) are available, there are no accounts of oil seeps that we know of. Additionally, the information available does not allow us to determine the "significance" of the gas seeps, related to baseline surface-water hydrocarbon levels in the Study Area. It is very likely that the methane seeping into the Pine, Animas, and other creeks along the outcrop volatilizes from the water by the time the rivers enter the SUIT Indian Reservation. Again, this precludes ascribing the term "significant" to baseline hydrocarbon levels in surface waters in the Study Area.

Q45 The referenced 1 mg/l threshold applies to wells associated with ECBM projects. The referenced infill order applies to Fruitland Coal seam wells drilled on fee land within the Southern Ute Indian Reservation. The 1 mg/l threshold for isotopic analysis is based on BLM policy resulting from research associated with the Tiffany ECBM Project, which found that explosive levels of methane can occur from concentrations of 1 mg/l or greater in water. The BLM believes that this policy is still valid, and no changes have been made in the FEIS in response to this comment.

Q46 The referenced statement has been revised in Section 4.5.2.8 of the FEIS.

Q47 Please see Comment Response Q46.

Q48 Please see Comment Response Q46.

Q49 Please see Comment Response Q46.

ASTRELLA & RICE PC
ATTORNEYS AT LAW

RECEIVED
MAR 20 2001
Bureau of Land Management
Durango Colorado

March 16, 2001

Mr. Don Englishman
BLM Environmental Protection
Specialists
San Juan Public Land Center
15 Burnette Court
Durango, Colorado 81301

Re: Comment on Draft Environmental Impact Statement
Dated October, 2000 For the Southern Ute Indian Tribe

Dear Mr. Englishman:

This firm represents numerous surface owners and local government entities throughout the Rocky Mountain Region in connection with issues concerning mineral development. The above-referenced draft EIS fails to consider a reasonable cost-effective alternative in drilling operations which would significantly lessen the environmental impact of drilling.

There is no consideration in the draft EIS of pitless drilling alternatives. Wells can be drilled without reserve pits at a cost which is less than drilling them with reserve pits. The advantages of using pitless drilling equipment on the rigs are as follows: R-1

- Footprint – smaller footprint with little surface disturbance; reduces delay in reclamation; avoids subsidence of reclaimed surface and minimizes erosion.
- Water – reduces water consumption by sixty percent.
- Traffic – reduces truck traffic by fifty to seventy-five percent; fewer water trucks, fluid disposal trucks and equipment to drill and reclaim pits; mitigates traffic danger, road use, air pollution and noise.
- Wildlife – reduces danger to wildlife and livestock.
- Waste – minimizes waste product disposal.

1801 Broadway, Suite 1600
Denver CO 80202
303 292 9021 fax 303 296 6347
http://www.astrellalaw.com

The benefits to the operator include the following:

- Pit Construction – eliminates cost of digging, segregating soil, lining, flagging and fencing.
- Pit Reclamation – eliminates pit dewatering, fluid disposal, reclamation, and subsidence correction.
- Archeological – reduces archeological costs where applicable.
- Water – reduces water hauling costs.

There are several service companies which can provide pitless drilling equipment and services, or can work with local drilling contractors to design such equipment for their rigs.

For more information on this subject, please feel free to contact me or one of the following individuals.

Reginald Wiemers
Wiemers Engineering
1131 E. Otero Place
Littleton, Colorado 80122
Phone: 303-298-1600

Eldon Ohlmann
Environmental Motion LLC
11667 US Hwy. 34
Greeley, Colorado 80634
Phone: 970-352-4363
Cell: 970-396-9714

Very truly yours,

Lance Astrella

Lance Astrella

LA:dlg

C:\WPDocs\O...Englishman.031501.ltr.wpd

Responses to Comment "R" from Lance Astrella, Astrella and Rice PC, Attorneys at Law

R1 Contained systems have been used and will continue to be used in applicable situations, to protect resources. These site-specific determinations are applied on a case-by-case basis and are attached as conditions of approval of APDs.

TO: Don Englishman, Minerals Supervisor
Bureau of Land Management
San Juan Field Office
15 Burnett Court
Durango, CO 81301
970-385-1346

RECEIVED

Signed: Erich Estelle

Date: 3/20/01 2:45pm

From: Carl Weston
3905 Hiway 550
Durango, CO 81303
970-247-7594
E-Mail crweston@mindspring.com

Subject: Public Comment
Oil And Gas Development
On The Southern Ute Indian Reservation
Environmental Impact Statement

I have resided and owned property within the Southern Ute Reservation boundaries for 33 years at SW 1/4, SW 1/4, SECT 31, T33N, 9W.

My comments on this EIS are inadequate and severely circumscribed because of the limited time allowed to study such a voluminous document that took six years to compile. Full semester college courses use smaller texts than this EIS. Technical jargon has no ordinary explanation that would provide the average citizen with an education level of high school plus two years, with an understanding of the impact being described. For example, "Maximum direct CO impacts during operation were predicted to be nearly 159 ug/m 3 (1 hour) and 110 ug/m 3 (8 hour)". Now what the hell are the health effects of living next door and down wind to that? with a pre-existing cardiac condition? during weather inversion conditions? S-1

At a minimum, an additional month is requested to study this tome. S-2

One of my stronger concerns is for the cumulative and synergistic impacts of localized air pollution under the least favorable meteorological conditions, especially in confined watershed topography. EPA has said that there are no monitoring facilities on the S.U Reservation that would measure those conditions. There is little point in comparing three alternatives, none of which can determine the localized (health) impacts on contiguous neighbors. Human respiration is a continuous vital process. It cannot be intermittent with a minimum number of adequate hours or days, like a tourist's view of the scenery. S-3

The lack of adequate localized monitoring facilities raises the issue of where and how non-Indian residents of the Reservation can effectively seek remedial action of unsatisfactory or non S-4

compliant air quality impacts. Where in this EIS is this level of mitigation addressed? It would appear to belong in the environmental justice section. S-4 (cont)

This EIS continually and extensively uses the term "ambient" to describe air quality standards without defining how uniform the air quality is within the area to which the term applies, or whether the "ambient" air quality can be statistically manipulated by including or excluding topography with greater or lesser levels of pollution. It would appear that the lower terrain of watershed courses should be specific separate "ambient" measurement areas, particularly since most of these areas are where residential development is concentrated. It also appears to be the preferred area for location of compressor stations. It is the area where inversion weather conditions most concentrate air pollution, especially at night. S-5

Adjusting residential exposure levels for "time away from home" is disingenuous sophistry. Elderly and pollution vulnerable residents are those most likely to be continuously confined at home. Human beings cannot be quantitatively or qualitatively measured as some statistical aggregate organic mixture like algae. They are as vulnerable to pollution impacts as the weakest, and most impaired, single individual, for the shortest period of time necessary to negatively impact human physiology at any age or stage of human existence, from unborn or newborn to frail elderly. Estimates of pollution impacts should be addressed using that standard. S-6

Wetland mitigation should have wetland avoidance as the first and highest priority. Wetlands created by produced or diverted water should not be eligible as "replacement" mitigation unless the sustaining water source can be legally and physically assured in perpetuity. S-7

There are a number of issues cited as " not been mapped", "not been formally studied", "difficult to quantify", etc.. These issues should be collated and categorized so the public can see and evaluate where the greatest number of unknown, ignored and unexamined issues lie. S-8

To be continued (contingent on extended comment deadline) S-9

Carl Weston

Responses to Comment "S" from Carl Weston, Individual

S1 Potential direct and cumulative air quality impacts were analyzed in order to determine if significant impacts would occur due to the Proposed Action or Alternatives (as reported in the DEIS pages 4-8 through 4-22; Chapter 4; 3.2 AIR QUALITY AND CLIMATE; sections 4.2.2 Impacts Common to All Alternatives, 4..3 Alternative 1 - Continuation of Present Management, 4.2.4 Alternative 2 - Coalbed Methane Infill Development, 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery, 4.2.6 Impacts Summary, 4.2.7 Cumulative Impacts, and 4.2.9 Unavoidable Adverse Impacts).

These potential impacts are based on an understanding of the: existing conditions (as reported in the DEIS pages 3-3 through 3-6; Chapter 3; 3.2 AIR QUALITY AND METEOROLOGY; 3.2.4 Existing Air Quality); anticipated meteorological conditions, air pollutant emissions, and state-of-the-art air pollutant dispersion modeling (as reported in the Air Quality Impact Assessment Technical Support Document (2000), prepared by Dames and Moore, and Earth Tech); and the predicted maximum direct and cumulative air quality impacts.

The predicted impacts were compared to applicable air quality health and welfare standards, PSD increments, and other scientifically based impact thresholds, to determine the significance of potential air quality impacts.

For example, regarding "Maximum direct CO impacts during operation," both the EPA and the State of Colorado have established primary Ambient Air Quality Standards for carbon monoxide (CO) to protect public health, including the health of "sensitive" populations (such as asthmatics, children, and the elderly), at concentrations of 40,000 $\mu g/m^3$ (averaged over one hour) and at 10,000 $\mu g/m^3$ (averaged over eight hours).

As stated in the DEIS (page 4-11; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery):

> The maximum direct CO impacts during operation were predicted to be nearly 159 $\mu g/m^3$ (1-hour) and 110 $\mu g/m^3$ (8-hour). When these values are added to the assumed background concentration of 2,300 $\mu g/m^3$, they become nearly 2,459 $\mu g/m^3$ (1-hour) and 2,410 $\mu g/m^3$ (8-hour), demonstrating compliance with the applicable CO NAAQS of 40,000 $\mu g/m^3$ (1-hour) and 10,000 $\mu g/m^3$ (8-hour), respectively.

What this means is that there would not be any significant "health effects of living next door and down wind ..." of the Proposed Action or Alternatives "with a pre-existing cardiac condition ..." "during weather inversion conditions ..." even based on the "reasonable, but conservative" analysis assumptions applied in the DEIS.

S2 Mr. Weston and the BLM agreed during a 3/21/01 phone conversation that Mr. Weston would submit any additional comments by 3/30/01.

S3 One of the most fundamental purposes of evaluating potential air quality impacts under NEPA is to compare both the direct and cumulative impacts of Alternative proposals, before a decision is made to approve or deny a specific activity. This "pre-decisional" comparison *cannot* be made based on monitoring data alone. That is why the DEIS used state-of-the-art air pollutant dispersion modeling (calculated on an hourly basis), along with an entire year of historically observed meteorological conditions, as well as "reasonable, but conservative" air pollutant emissions assumptions, in order to determine potential significant air quality impacts, including both "localized (health) impacts" and regional environmental impacts.

S4 As described in the DEIS (page 1-9; Chapter 1; 1.7 ENVIRONMENTAL JUSTICE): "The purpose of [Executive Order 12898]...is to identify and address, as appropriate, disproportionately high or adverse human health and environmental effects of programs, policies, or activities on minority or low income populations."

Given this "programmatic" nature of the air quality impact assessment, specific source and receptor (residence) locations are not known. Based on the intensive air quality impact analysis performed throughout the entire modeling domain, however, no disproportionate negative air quality impact on minority or low-income populations is expected to occur under the Proposed Action or Alternatives.

Regarding "where and how non-Indian residents of the Reservation can effectively seek remedial action of unsatisfactory or non compliant air quality impacts," please also see Comment Responses A1 and Q28.

S5 The term "ambient" simply means "areas where the general public has access." National and state Ambient Air Quality Standards are applicable in these locations, whereas within the physical boundary of a business, Occupational Safety and Health Administration (OSHA) workplace standards apply.

The entire modeling domain, including "lower terrain of watershed courses," the mountainous Weminuche Wilderness Area, and all the rolling terrain in between, was compared to the "ambient" standards, based on a full year of meteorological conditions (including "inversions").

S6 The DEIS presented two different potential incremental cancer risks for the maximum predicted formaldehyde concentrations, based on the unit risk factor developed by EPA, as reported in its "Integrated Risk Information System Database." The EPA procedures do not assume separate potential unit risks based on age. The Maximally Exposed Individual (or MEI) analysis was *not* adjusted for "time away from home." It was based on continuous exposure of the maximum predicted impact (a very conservative assumption) for the entire 20-year operational period of a typical well. EPA's procedures do include an adjustment for period of residence and "time away from home" for the Most Likely Exposure (MLE) analysis, however.

Finally, as stated in the DEIS (page 4-12; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery) for both the MEI and MLE analyses:

> ... the predicted incremental cancer risks for the inhalation pathway all fall below or at the lower end of the 1 x 10^{-6} to 100 x 10^{-6} threshold range. Given the conservative nature of these analyses, the predicted exposures are likely to overstate actual exposures, and the potential incremental cancer risks would not be significant.

S7 Wetlands mitigation involves avoidance to the fullest extent possible, without compromising the intent of the project (Section 4.3.1.8). Permanent wetlands would be created, if required, as wetland-replacement mitigation, through consultation with the Army Corps of Engineers.

S8 We believe that collating these terms would not add to public or decision-maker understanding of the proposed action or the Alternatives. In cases where information is not mapped or studied, it is either because related studies or inventories are not available, or the information does not contribute substantively to our understanding of the issues. In instances where we state that something is difficult to quantify, it refers to our description of effects that are either not quantifiable or are most effectively described qualitatively.

S9 Please see response to comment S2.

IBR4DM30.4DUR1PO: WHurley@BORGroup wise
To: denglish@BLM
cc: BHarrill@BIA, karringt@BLM
Subject: Comments, SUIT Oil & Gas DEIS [Virus checked]

03/20/01 04:00 PM

Mr. Englishman:

The following are my comments on the SUIT Oil & Gas Draft EIS (SUIT DEIS).

General:

Throughout, the SUIT DEIS makes reference to the Animas-La Plata Project (ALP). However the most recent reference to the ALP is 1996. The configuration of the ALP has changed considerably since 1996, and what is contained in the SUIT DEIS is a mischaracterization of the present ALP. In particular relevance to the SUIT DEIS Study Area is the elimination of irrigation features and a reservoir on Southern Ute lands, and replaced by various other scenarios of water use. I suggest using the more recent ALP Final Supplemental Environmental Impact Statement of July 2000, and Record of Decision of September 2000 to describe the interface between Oil and Gas development on Southern Ute lands and the Animas-La Plata Project. T-1

Cultural Resources:

The following pertain mostly to the cultural resources sections and Appendix K. In general, I found the sections and Appendix to be very well done and comprehensive. It makes optimum use of the available data to describe the cultural environment and potential impacts.

However, the SUIT DEIS concludes that significant impacts to cultural resources should be prevented based upon mitigation and avoidance (pp ES-2, ES-10 (Table ES-1), Table 2-2 (pp 2-31,32)) . It is not adequately demonstrated how this can be accomplished, in light of the fact that under the Preferred Alternative almost three times as many sites would be present than under the No Action Alternative. T-2
Page 4-170 incorrectly states that in cases where impacts to archaeological sites are unavoidable, "no adverse effect" determinations can be made through data recovery (and therefore there are no significant impacts). Under 36 CFR 800, an "adverse effect" can not be made "not adverse" through data recovery. T-3

In regard to Traditional Cultural use/cultural affinity of the Study Area, the DEIS is very incomplete. It relies almost exclusively on Reclamation's ethnographic study conducted for the ALP (pp 3-110 and 3-111, unreferenced, and p 4-174) to describe what traditional cultural properties are in the study area and what the impacts may be. While there is some applicability, the ALP ethnographic study results should not be construed to be representative of the entire Southern Ute Indian Reservation. The DEIS indicates that it is likely that other Tribes (than Southern Ute) claim affinity to archaeological sites in the study area but no consultation has been initiated, as is required. I suggest conducting an ethnographic study/consultation with the Tribes (including identifying Culturally Important Plant areas described in Sections 3.3 and 4.3) for the Final EIS. T-4

Appendix K:

Many of the above comments apply to corresponding sections of Appendix K. T-5

More specifically:

Page K-3:
No formal section 106 consultations have been undertaken because of the "programmatic" nature of oil and gas development. To the contrary, I suggest that it would be expected that consultation would have T-6

COMMENT T

occurred and a Programmatic Agreement Document in preparation for a project of this scale. T-6 (cont)

The document refers to the ALP as an "Irrigation project". See general comment, above. T-7

K-26:
Under Special Status Cultural Resources, add that Ridges Basin (La Plata County), along the northern boundary of the SUIR, has been determined eligible as a National Register District, but is outside of the oil and gas leasing and development area. Northern Arizona University has completed a seven-volume series on Ridges Basin and the surrounding area, which has some relevance to the Study Area. It will be provided to the BLM/BIA (or their consultants) upon request. T-8

K-27,28:
Reclamation has completed a Jicarilla Apache Ethnobotany study relevant to the Study Area (and relevant to the Culturally Important Plants subject matter), which will be provided to the BLM/BIA (or their consultants) upon request. T-9

K-32-42, and elsewhere:
Reclamation has conducted a number of recent investigations in the southeastern corner of the Study Area (at Navajo Reservoir), which were not referenced. They will be provided to the BLM/BIA (or their consultants) upon request. T-10

K-72:
The NHPA section cites an obsolete version of 36 CFR 800. The data recovery exception to the criterion of adverse effect no longer exists. Under present regulations, adverse effects can be "resolved" through data recovery, but they remain adverse. This places the conclusions of this section (on K-73) and the section on Criteria for Significant Impacts (on pages K-74 and K-75) in doubt. T-11

K-80, K-81:
The potential impacts described for the Animas-La Plata Project are in error. The study cited (Chenault 1996) was for an irrigation component of the ALP that has since been eliminated. I suggest using the impacts analysis provided in the July 2000 FSFES. The cultural resources analysis report is forthcoming and will be provided to the BIA/BLM (or their consultants) if requested. T-12

Thank you for the opportunity to comment on the SUIT DEIS. Please incorporate my views into the public/agency review process.

Warren F.X. Hurley
Archaeologist
USDI Bureau of Reclamation
Western Colorado Area Office

Responses to Comment "T" from Warren Hurley, USDI, Bureau of Reclamation

T1 The FEIS has been updated as appropriate to reflect the current status of the Animas-La Plata Project.

T2 We agree that site protection measures will vary by Alternative, depending on the site density. However, site avoidance and mitigation is the routine treatment for historic properties in all Alternatives. Where complete avoidance is not possible, testing and data recovery will be conducted. Please refer to the archaeological-mitigation summary in Section 4.8.9 of the DEIS. This standard for archaeological protection is demonstrated by past practice. Well pads and pipeline rights-of-way have routinely been relocated to avoid archaeological sites. In some instances, where well pads could not be located in the drilling window, either the well was directionally drilled from outside the window or was not drilled at all. Pipelines are rerouted around archaeological sites. We recognize that for some APDs, site avoidance and data recovery may not be feasible site protection measures, and other treatment approaches will be required.

T3 We agree with this statement and have changed the text in Chapter 4 and Appendix K to reflect the fact that although adverse effects may be "resolved" through data recovery, they are still considered adverse.

T4 It is the intention of the tribe and the BIA to use avoidance as the first mitigative measure in preserving archaeological sites, as well as areas containing culturally important plants. All of the plant species outlined in Section 3.3.2.3 are surveyed during project-specific on-sites at the APD level, and their avoidance or other means of mitigation is outlined in the Biological Assessment for the individual project Please refer to Sections 4.3.1.8 and 4.8.9 of the EIS. Please also see Comment Response T6.

T5 Appendix K has been revised as appropriate.

T6 We agree, and we are conducting formal consultation under Section 106 with the tribes and SHPO. The consultation process will be a factor in deciding if a programmatic-agreement document should be developed.

T7 Appendix K has been revised in response to this comment.

T8 Appendix K has been revised in response to this comment.

T9 Comment noted.

T10 The studies referred to in this comment are in an area of the Southern Ute Indian Reservation where there is no planned oil and gas development.

T11 These conclusions were based on the version of 36 CFR 800 that was in effect at the time of writing, before the CFR's July 2000 revision. We agree with the statement that, under the new revision, adverse effects may be "resolved" through data recovery but remain adverse. We have modified the text accordingly. The conclusion of this section–that "Determinations of adverse effect are expected to be warranted only rarely, if at all"–is still valid, however.

T12 We agree, and the EIS and Appendix K have been modified to reflect the current status of the Animas-La Plata Project.

Calvin Joyner, Director
San Juan Field Office
Bureau of Land Management
15 Burnett Court
Durango, Colorado 81301

March 27, 2001

RE: Comments on the Southern Ute Indian Tribe Oil and Gas Program Draft Environmental Impact Statement

Dear Mr. Joyner,

The San Juan Citizens Alliance (Alliance) and the Oil and Gas Accountability Project (OGAP) file these comments jointly with the hope that you will review them and take action to ensure that current NEPA Process for the Southern Ute Indian Tribe Oil and Gas Program will be completed in accordance with the high standards and legal requirements that guide your work. Unfortunately, the DEIS does not meet these standards and requirements. Fortunately, the give and take of the NEPA Process does allow the shortcomings to be remedied by withdrawing the current DEIS and releasing a new DEIS for public and interagency review. The many reasons for requesting withdrawal of the DEIS are detailed below.

Introduction

The Draft EIS does not meet basic tenants of NEPA's requirement that BLM release an interdisciplinary document that encourages public participation and input. As detailed below, the document was released in incomplete form, without maps, graphs, and charts. The failure to provide printed maps is illustrative of the large gaps in information and analysis that characterize the DEIS. U-1

The range of alternatives is not reasonable and does not include a no action or any alternative that seek remediation of known problems. The need for additional wells is not demonstrated. Mitigation measures are listed to "include, but are not limited to," with no indication what mitigation measures will normally be required to address impacts on a programmatic level. U-2

Plain English and full revelation of impacts are not provided The lack of candor, unsupported data, and unreadable language that characterize this EIS are illustrated by excerpts related to water impacts:

> As the conditions that must be met to produce an impact are many and quite complex, the potential impacts identified are not quantified. DEIS at 4-108 (Groundwater impacts).

> There currently are no known surface water data for streams in this area that can be used for the establishment of baseline water quality or quantity conditions, including concentrations of PAHs or hydrocarbons in surface water or sediment. DEIS at 4-126.

Annual flow in the rivers in the northern San Juan Basin totals over one million acre-feet per year. (Maynes, 2000, pers[onal]. comm[unication].). DEIS at 4-111.

For example, a watershed comprising both Tribal and non-Tribal coal land could contain contaminants in receiving surface waters, with no definitive transport pathway that leads to a point source. DEIS at 4-116.

These are not isolated examples. Omission and obfuscation characterize this DEIS.

At many times, there are discrepancies between the CD-ROM and the printed version, leaving the reader to wonder which of the two versions of the DEIS was intended for release. U-3

These comments cite the page numbers that correspond to the printed copy that was provided.

Simply put, it is impossible for this DEIS to be reworked into a legally sufficient Final EIS without release for public and agency comment. The Alliance and OGAP request that the responsible officials in the BLM and BIA uphold the public trust by shifting agency resources from permitting additional wells and expeditiously rework this DEIS into a document that can be released for public comment and that meets basic NEPA requirements.

Further permitting of wells and other facilities is not legally possible until this long-delayed NEPA Process is completed. As alleged in the pending federal lawsuit, any wells permitted without the completion of this NEPA Process are illegal. Further, any further drilling is highly likely to be in flagrant violation of the Endangered Species Act consultation requirements and the prohibitions on harm and habitat modifications. A shift in resources to this NEPA Process that began in 1995 would ultimately produce better decisions, more efficient and orderly production, an informed public (Indian and non-Indian residents), a better environment, and would save resources now dedicated to litigation.

Public Involvement

The single public hearing discouraged involvement of public. NEPA requires agencies to design public processes that attract public participation. Whether intentional or negligent, BLM has not made the efforts required by CEQ regulations to take affirmative steps to encourage public involvement. Many people have said that they would not attend an open house that provided no opportunity to hear from the agencies or the general public.

Further, the hearing was not promoted with the vigor that a decision of this magnitude demands. Some people complained that they had a very difficult time finding the meeting. There were no signs directing people into the area of the Sky Ute Casino where the meeting was held. U-4

An open house was held, but no formal public hearing was held as was stated at page 5-10 of the DEIS. There was no presentation by the responsible agencies. Attendees could ask questions of the agency personnel, but the answers were not recorded. The BLM personnel present lacked the interdisciplinary character required by NEPA. A court reporter sat in one corner of the room taking statements. A worse method for encouraging public participation would be difficult to design. A better method for insulating decisionmakers from public sentiment is difficult to imagine.

Only approximately 15 people attended the open house. In the past, hundreds of people have attended well-publicized public hearings on oil and gas issues in this area. It is exactly the

public concerns and the public outrage that decisionmakers like Area Supervisor Cal Joyner and State Director Ann Morgan must understand in order to make a fully informed decision. Unfortunately, this DEIS allows the oil and gas shop to continue to operate insulated from interdisciplinary staff analysis and public involvement that NEPA requires.

Plain English – Readability

The public was not provided with maps and charts designed to aid understanding and which sometimes provided key information. When maps were requested, people were referred by the agencies to the CD-ROM. Even federal agency personnel had problems handling CD-ROM versions of the maps. Basically, a DEIS that has been in the works since 1995 was released by the federal agencies to the public in 2001 unfinished and incomplete.

It should be noted that the BLM made special effort to provide printed maps to Travis Stills in his capacity as attorney for the San Juan Citizens Alliance. The maps that were provided to a single attorney are not particularly readable or helpful for wide public understanding. Many of the maps are utterly unreadable due the choice of colors used for the legends, especially those detailing land and mineral ownership patterns. see: Map 2, 17, 18. Pale yellows are used throughout the maps, rendering the maps nearly unreadable and blurring distinctions that use of color keys is supposed to accentuate. All of the maps are dated September, 1999, and were a full year and a half old upon release, making them unreliable sources of information. It is not entirely clear who was provided with a fully printed version. A serious breach of the public trust occurs when agencies provide only select persons with full copies of a NEPA document. U-5

Most importantly, the general public had no easy access to the maps, charts, and diagrams that made text understandable and which were sometimes the only source of particular types of information in the document. The DEIS needs to be reprinted and released in a form accessible to the general public that NEPA is designed to inform and involve. The comment period needs to be re-opened to allow public comment based on a complete and reliable printed document.

Purpose and Need

The purpose and needs section of the DEIS fails to meet the mandatory requirement that EISs "shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action." 40 CFR 1502.13. The DEIS neither attempts to describe the purpose nor the need for implementing the proposed action – the intensification of the gas development program. As described below in the comments on the lack of alternatives, it is quite likely that more wells and enhancement techniques are not necessary to full and efficient production of gas resources. It is also quite likely that accelerated production will have disproportionate benefits among the various interests involved. What is certain is that the underlying purpose and need for more has not been stated with specificity and accuracy. U-6

The DEIS does partially restate the purpose of preparing the EIS. A much more accurately statement of the purpose of an EIS is provided by the regulations:

> The primary purpose of an environmental impact statement is to serve as an action-forcing device to insure that the policies and goals defined in the Act are infused into the

ongoing programs and actions of the Federal Government. It shall provide full and fair discussion of significant environmental impacts and shall inform decisionmakers and the public of the reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. Agencies shall focus on significant environmental issues and alternatives and shall reduce paperwork and the accumulation of extraneous background data. Statements shall be concise, clear, and to the point, and shall be supported by evidence that the agency has made the necessary environmental analyses. An environmental impact statement is more than a disclosure document. It shall be used by Federal officials in conjunction with other relevant material to plan actions and make decisions.

40 CFR 1502.1. Unfortunately, this DEIS fails to meet the NEPA purposes at almost every turn.

The DEIS does recognizes that a central purpose of an EIS in a checkerboard reservation such as the SUR must be to inform SUIT, BIA, BLM and other decisionmakers. DEIS 1-4-5. However, there is no recognition of an equally important purpose, to inform allottees, non-Indian residents living within the reservation, and others who might be interested in the environmental impacts of the oil and gas development. The lack of attention to public information purpose of NEPA is reflected in nearly every aspect of the DEIS. This type of sheltered approach to NEPA documentation is now uncommon in most federal programs, yet it continues to characterize the federal oil and gas program. The lack of commitment to public involvement and environmental protection is well known throughout the otherwise responsible and responsive federal agency employees who, like the Alliance and OGAP, are seeking to bring the oil and gas program into compliance with even the most basic of requirements of federal law. U-7

The lack of attention to the diversity of opinions within the Tribal membership and among allottees is consistent with the legacy of abuse of tribal members by a Department of the Interior focused on oil and gas production. The lack of attention reflects the oil and gas program's insulation from the interdisciplinary mandates that apply to all federal activities. This NEPA process must everyone, especially tribal citizens and allottees, of the impacts and the full range of alternatives that includes no action and remediation. The DEIS does recognize that private CBM development may damage Tribal Coal Only Lands, yet no mitigation or protections are contemplated for Coal Only lands. DEIS at 1.4. The historic preference of DOI for energy production over the legitimate concerns of environmental and resource protections is evident throughout the document. DEIS at 1.4. The legacy of the federal oil and gas program's failure to take NEPA purposes seriously must not extend past the current DEIS. A new DEIS must be released that implements the NEPA purposes. U-8

<u>Scope</u>

The Alliance has requested a San Juan Basin-wide EIS since the late 1980s. In response to lawsuits and requests, three programmatic NEPA Processes are underway throughout the basin – two in the San Juan Field office (SUIT EIS, Northern EIS), and one in the Farmington, New Mexico Field Office. Instead of the current inefficient and segmented approach, these EISs should be prepared and released as one basin-wide EIS that discloses the full impacts of the 20,000 existing wells and the potential 20-40,000 wells that are being contemplated basin-wide. U-9

In response to the Alliance request for a basin-wide EIS, the SUIT DEIS reports that the study must be focused on the reservation. DEIS at 2.3.3. Yet, the very next section recognizes

the possibility of leasing on the eastern portion of the Reservation. DEIS at 2.3.4. The reason for not analyzing the potential development in the eastern portion is that the "Tribe has no current plans for development." Id. The conflicting rational in the DEIS reveals that focus on the SUIT reservation issues is a mere pretense for avoiding a basin-wide EIS since the SUIT DEIS itself covers only about sixty-one percent of the Reservation acreage. DEIS at Figure 1. U-9 (cont)

Another possible reason for limiting the study area to the Western half of the Reservation is that it omits the downwind half of the reservation. Anyone who has studied air quality issues is familiar with the fact that the Northeastern United States is heavily impacted by industrial activity in the Ohio River Valley – which is downwind and to the west. Here, the impacts of deposition and other downwind phenomenon are being ignored because of the limited scope of the EIS.

The best, and only legal, way to address the cumulative impacts of the oil and gas development in the San Juan Basin is to make the scope of the study match the scope of the activity that extends across the San Juan Basin. The cumulative impacts of air emissions, water discharges, pipeline requirements, wildlife impacts and any number of other actions simply cannot be disclosed and analyzed in several artificially segmented DEIS's.

Memorandum of Understanding

The DEIS recognizes in two paragraphs that it has contracted with the Colorado Oil and Gas Conservation Commission "to conduct hearings and review BLM jurisdictional matters affecting Indian lands" and that any decision of the "COGCC that is not protested by the BLM is deemed to be a decision of the BLM." DEIS at 1.5.2. Yet, despite Alliance requests and lawsuits, the BLM has committed resources and regularly makes these decisions without NEPA compliance. U-10

Similarly alarming, none of the Memoranda of Understanding have been subjected to NEPA analysis for consideration of alternatives, disclosure of impacts, or public input. Mere mention of the MOUs in this document does not cure this serious defect. The MOUs must be subjected to full NEPA consideration and this programmatic NEPA process is the appropriate time and place to do so. Further, all activities that have been illegally contracted to the COGCC or which have been approved through the improper and illegal COGCC/BLM contracts must halt pending NEPA compliance. U-11

The fact that at least five of the seven members of the COGCC have strong ties to production companies or actually draw paychecks from the oil and gas industry compound the lack of public involvement and disclosure that characterize the oil and gas program under review in this DEIS. Certainly, numerous trusts, whether owed to Indian Tribes, allottees, or the general public, have been breached by the illegal arrangements with an industry-dominated COGCC. The effective result is that federal responsibilities have been given over to the oil and gas industry itself under MOUs. Even if the BLM and BIA decisionmakers could properly enter into these MOUs, their actions must be first subjected to NEPA analysis. U-12

Existing Rights, Agreements, and Necessary Agency Actions

The existing rights that are being analyzed in the DEIS are discussed in the general and the abstract. DEIS at 1.6. However, all of the existing rights under examination already contain a variety of leases and stipulations that must be disclosed before a full examination of impacts U-13

and alternatives can be examined. The necessity for such an examination is consistent with the recent opinion that explains the effect of leases in relationship to Colorado common law and the statutory authority granted to COGCC and Colorado County governments. Of course, similar to the preemption arguments forwarded by the COGCC and industry groups in the state litigation, the general rule of law is that the federal authority preempts conflicting state laws. Without an articulation of the rights involved, a reasoned analysis cannot follow. U-13 (cont)

Alternatives

Reasonably Foreseeable Development Scenario

Neither Section 2.2 of the DEIS nor Appendix C provide a description of the Reasonably Foreseeable Development Scenario (RFD Scenario). RFDs form a central role in any federal oil and gas program. Instead of an a RFD scenario, the DEIS relies upon vague references to "known resource conditions" that provide no evidence that the DEIS is based on sound data and information.

The DEIS states that due to "known resource conditions, such as production rates and water disposal issues" not every 320 acre spacing unit would require a second producing CBM well. DEIS at 2-6. Yet, these "known resource conditions" are not revealed in the DEIS and are not set out in a manner that delineates where well densities would be double and where they would not. U-14

Absolutely no "known resource conditions" were discussed concerning conventional wells. For enhancement projects, the DEIS is based on an unsupported industry estimate. Little additional data was provided, except for a statement of "professional judgment." DEIS at 2-6. The RFDs and the reasonableness of the alternatives that flow from them are not supported by data in this DEIS. The RFDs have the appearance of being industry wish lists, converted by the DEIS prepares into "alternatives." The DEIS is fatally flawed because it lacks detailed description of the alternatives and the RFDs that the alternatives are based upon.

"No Action" Alternative Requires Examination of No New Wells and Facilities

The decision not to address a development moratorium reveals the lack of serious attention to the NEPA process by BLM and BIA when it comes to oil and gas development. The unsupported parade of horrible consequences reveal a biased approach to the NEPA process with more drilling as the predetermined outcome. DEIS at 2.3.1 The alternatives are based on an unsupported assumption that more drilling is needed, skipping entirely the real possibility that no further wells are needed to extract the conventional and CBM gas.

The BLM has concluded in other documents that the current intensity of wells is enough to recover all gas in place. U-15

> The infill well spacing of 160 acres will recover the gas over a 20 to 40 year period, whereas the 320 acre spacing would require 100+ years to recover the same amount of gas.

Attachment 1 (Section VI., excerpted from BLM Technical Analysis of Infill Drilling Interim Criteria, as provided to La Plata County by John Pecor on July 7, 2000). Thus, BLM has

documented the fact that more wells are not needed to recover the gas, but that the economics drives the number of wells. A commitment to develop mineral resources in an economic and environmentally sound manner must consider how well the current level of development will recover resources across a the heterogeneous geology of the region. A no action alternative must be included that discloses the very real possibility that unnecessary capital investment would cause inefficient production and may benefit some production participants at the expense of others. U-15 (cont)

If in fact the proposal for more wells is driven by economics, there needs to be a competent economic analysis that uses accepted methods to reveal whether it is economic to drill technically unnecessary wells. Uncontroverted expert testimony was provided to the Colorado Oil and Gas Commission that revealed the Commissioners relied strictly on industry's financial data to reach the conclusion that intensified drilling is supportable. The COGCC decision to allow more wells has not been opened to NEPA scrutiny until now. BLM's adoption of the COGCC decision cannot stand until the need for more wells has been fully disclosed and examined.

The DEIS's hyperbolic rejection of no further drilling alternatives is irrelevant to the need to consider the economic and environmental ramifications of a no action alternative that assumes no further drilling is necessary. DEIS at 2.3.1. Without full consideration of a "no action" alternative, this DEIS is nothing but an meaningless paperwork exercise.

Fruitland Formation Eighty-acre Well Density

The lack of analysis of eighty-acre spacing is equally flawed. DEIS at 2.3.4. The Alliance agrees that competent analyses will demonstrate that eighty-acre spacing is not practical or expected. Yet, industry representatives have publicly expressed its desire to move to eighty-acre spacings and the COGCC director has acknowledged that economics might make eighty-acre spacing attractive. In order to make the EIS a working document that informs decisionmakers and the public, the data and reasoning behind the conclusion that eighty-acre spacing is not practical or expected needs to be fully disclosed and support by data that demonstrates that unnecessary drilling is being driven by uneconomical and environmentally destructive accelerated production that will reap financial rewards to select development proponents. U-16

Reasonable Range of Alternatives

The proposal to drill 350 additional wells cannot be used as the legally required "no-action alternative." The cagey description of the increase drilling alternative fails to reveal that CBM infill development has been ongoing since at least 1993 without NEPA analysis that considers cumulative impacts of 160 acre spacing. BLM has approved dozens of 160 acre-spaced CBM wells under cookie cutter EAs. The proposition that "current spacing will include some infill development as operators test the viability" can only be read as an intentional attempt to evade NEPA review that is provided fully in an EIS. DEIS at 2.4.1. U-17

Current management direction was approved under a ten year old Environmental Assessment that did not consider or reveal many of the impacts of the oil and gas program, especially the fledgling coalbed methane technology. Since this is the first time that this program will be exposed to full public and interagency review required by NEPA, the details of U-18

V-18 (cont)

Alternative 1 must be disclosed fully in this DEIS without reliance on the 1990 EA.

The "viability and merits" of drilling more wells under Alternative 2 is based on "engineering studies" that are not revealed in the DEIS alternative discussion. DEIS 2.3.2. Again, increased production, recovery and "economic return to the lessor/royalty owner" are not based on supporting data in the DEIS. Further, it is quite possible that the conclusion of increased economic return to the lessor and royalty owner is not economically sound. But, there is no methodology and no data to review to assess the true economic implications of the proposal. It is quite likely that accelerated production will require unnecessary and unwise use and depletion of capital, labor, and natural resources. Yet, there is no analysis in the DEIS that addresses this central question regarding viability and merits of more drilling. V-19

Alternative 3 improperly lumps the "injection of nitrogen, carbon dioxide, or other fluids into the Fruitland Formation" onto the increased drilling alternative presented in Alternative 2. The consequences and advantages of these enhancement methods must be revealed independently of the other two increased drilling alternatives. One cannot make a reasoned decision on this DEIS whether or not enhancement could be used in lieu of additional drilling. Further, it may be possible, but undeterminable on this DEIS, that some wells could be plugged and abandoned, rendered unnecessary by technological innovations. It could also be possible that these injection methods are so objectionable that they should not be used under any circumstances. Again, Alternative 3 was designed in a manner that prevents determination of these serious questions. V-20

Alternative 3, in addition to being the agency preferred alternative, could be appropriately labeled "appropriate maximum impacts alternative." Perhaps the most impacting alternative will eventually be chosen. But, NEPA requires development and presentation of a full range of alternatives. Perhaps when faced for the first time with a full range of choices laid out in a NEPA document, the relevant decisionmakers will no longer prefer the maximum impact alternative. This DEIS needs to be pulled back and reissued with a full range of alternatives for public and agency comment. A record of decision based on the range of alternatives and analysis in this DEIS does not meet the ordinarily high standards required of federal agencies.

The Alternatives Analysis Framework Reflects Flawed Alternatives

Several distinct activities are lumped together in the alternatives, preventing a reasoned analysis of the impacts of each activity. The following are among the distinct categories of activity that need distinct consideration: V-21

CBM wells in the Fruitland Formation
Conventional gas wells in the Pictured Cliffs Formation
Conventional gas wells in the Mesaverde Formation
Conventional gas wells in the Dakota Formation
Conventional gas wells in the Gallop Formation
Other reasonably foreseeable conventional and non-conventional development

Further, the following are examples of alternative production techniques that have not been compared for efficacy or for the associated impacts: V-22

Drilling More Wells Closer Together

Enhanced Production Techniques
Cavitation
Hydraulic Fracturing
Carbon Sequestration
Use of Industrial Exhausts as Sources of Carbon Dioxide
Recompletion
Directional Drilling
Low Profile Electric Pumps
Bioremediation Techniques

V-22 (cont)

The impacts for the following categories of facilities that may be necessitated by expanded or accelerated production have not disclosed:

Additional dispersed treatment facilities
Additional field compression
Expansion and modification of central delivery points
Expansion and modification of central treatment facilities
Expansion and modification of central compression facilities.

V-23

Flawed Assumptions Render the DEIS Arbitrary and Capricious

In addition to the omission or disregard of important areas of analysis, the assumptions used throughout the DEIS are unreasonable, arbitrary and capricious. One needs only read the DEIS to understand that the analysis bears little relationship to known resource characteristics and likely development scenarios:

> For analysis purposes in this EIS, potential conventional well development was considered to occur equally throughout the Conventional Well Area, **although it is likely** that **actual development sites would be concentrated** in areas with higher production potential and would be controlled by the spacing limitations of the targeted formation and field.

V-24

DEIS at 2-11. Further, the DEIS state that the "fairway probably already contains a sufficient number of CBM wells to efficiently drain the CBM spacing units there." DEIS at 2-11. Even though these clear distinctions are made in the DEIS and other agency documentation, there is no alternative that reflects a distinct and identifiable reason to address a development scenario that includes no new drilling in many if not all areas.

V-25

It is unclear whether any development will be allowed in the fairway region, and if it is how "go/no-go" decisions will be decided at the APD level. The DEIS states that "for analysis purposes in this EIS, CBM well development was considered to occur in all three areas, but with a much lower rate of infill development in the fairway." DEIS at 2-12. Map 3 has no green areas to reflect any development in the fairway. Yet, review of Map 4 shows no deviation in drilling intensity between the fairway and non-fairway areas. The DEIS itself suggests that this DEIS has little to no basis in fact or structured alternatives, but is an arbitrary and capricious attempt to satisfy NEPA requirements by producing a large stack of paper that is devoid of the disclosures and reasonable alternatives that lie at the heart of the NEPA process.

V-26

The impacts analysis is a similar exercise in paperwork, lacking informed on-the-ground analysis of the area. Instead of reasoned analysis based on observation and study, a statistical methodology was developed that treats development inside the town of Ignacio the same as the development in the more remote and less populated areas of the Reservation. More false assumptions ignore the well established premise that intensified development will not be uniform across the study area: "Under Alternative 1, the present 320-acre well spacing was used as the development window for evaluation of impacts, even though it is predicted that some of the 81 CBM wells developed under this alternative would be infill wells." DEIS 2-13. U-27

Appendix D provides no further real world support for the impacts methodology other than touting the power of geographical information systems (GIS) "to map, display and analyze impacts." DEIS at D-1. The normal pad sizes, access road size and flowline requirements are completely unsupported and appear to be drawn from whole cloth. Nowhere is there an analysis of existing pads, best management practices, or enforceable mitigation measures that suggest the data fed into the powerful GIS system is reliable. Even the most powerful electronic gadgets are susceptible the old adage, "garbage in, garbage out" (GIGO). Perhaps these gadgets even invite improper use of computer reports instead of analysis that is substantiated by on-the-ground analysis. Federal land management agencies have historically shunned the former in favor of the latter. U-28

The ability to make estimates of the specific areas that will be impacted is available through various sources, especially the locations provided by the COGCC orders that set the spacing and locations of wells. Of course, this NEPA Process must examine all aspects of the spacing, location and siting of wells. The spacing and location has been established with some certainty by the COGCC, but the federal agencies and the Tribe retain the power and discretion to alter these decisions based on the information provided in this NEPA Process. The only step that requires information that is not absolutely certain at the time this programmatic EIS is the exact "siting" of wells within the 20 acre drilling window. U-29

This DEIS should be pulled and the assumptions matched against observations and enforceable management practices. Again, the maps that accompany the description of the assumptions are either absent or unreadable due to lack of readable legends. The DEIS should then be released again for public and agency comment. U-30

The Alternatives are too Overlapping and Narrow to Allow Clear Comparisons

The Comparison of Alternatives bears out the problems with overlapping and unclear alternatives. The alternatives, as presented, are simply so confused that the DEIS fails to reveal the individual and cumulative impacts of any specific activity. The NEPA process is designed to provide analysis of a range of alternatives that aid understanding of the public and decisionmakers. Instead, the alternatives presented in this DEIS confuse and obfuscate the cause of the impacts due to the omission of no action alternative. The comparison of the impacts is done within a range three alternatives that provide varying levels of increased intensity of CBM, conventional gas, and enhanced production methods. U-31

Astonishingly, nowhere in the EIS is the intensity of unconventional wells varied, all three alternatives, even the no-action alternative, assume development of 269 conventional wells. DEIS at Table 2-1, page 2-5. There can be no clearer example of a lack of adherence to the alternatives analysis that is required by NEPA. 40 CFR 1502.14. A new DEIS with a range of alternatives is needed that isolates each activity, varies the intensity, examines impacts, and U-32

COMMENT U

compares the impacts to each other and the no action alternative. V-32 (cont)

Further, there should be a range of "remedial alternatives" that looks past "no action" and reveals and considers methods that should be used to identify and remedy current problems. County advisor Warren Holland testified under oath to the COGCC that it may be necessary to plug and abandon some wells that are causing unacceptable impacts. The methods that have been or will be used extinguish coal fires must be revealed and the impacts disclosed. These remedial actions are foreseeable and the impacts and range of available alternatives must be disclosed in this DEIS. If not, a full EIS may be necessary whenever remedial actions are required of lessees. This EIS is the proper time to examine alternatives to the current development program that is plagued by real problems. V-33

Alternative stipulations, mitigation measures, and conditions of approval alternatives were not offered. Only the intensity of development was varied. Requiring conditions of approval or altering lease stipulations are the central methods for controlling the intensity of impacts. Yet the DEIS lacks examination of alternative methods to impose mitigation measures. 40 CFR 1502.14(f). Inclusion of these mitigation measures by reference in the alternatives analysis reflects the lack of serious consideration of adopting specific and binding mitigation measures. DEIS 2-73 to 2-75. V-34

Instead, a mitigation strategy, including mitigation of cumulative impacts, is deferred to the APD stage. While this may be proper for some aspects of the mitigation measures, the agencies must recognize that deferring the consideration of all mitigation measures to the APD stage without specific consideration at this stage may require completion of full EISs at the APD stage. There will be no ability to tier to a broader EIS analysis of cumulative effect of various mitigation measures. V-35

Disclosure of the cumulative and synergistic impacts of various mitigation measures that are necessary for widespread problems such as air and water pollution as well as habitat impacts require landscape level strategies that are not proper for analysis at the APD level. Subsequent delays and inefficiencies will result from delaying the inevitable full EIS on mitigation measures if these deficiencies are not resolved. V-36

Affected Environment

The absence of serious Environmental Justice issues is consistent with the well-documented history of abuses that involve resources extraction on Indian Reservations. The DEIS must prepare a full analysis of the Environmental Justice issues that surround the SUIT oil and gas development. V-37

In addition to the recognized minority populations, there is an abundance of low income people in the study area that independently trigger the requirement for an environmental justice analysis. The low-income analysis is separate and distinct from the analysis of minorities. Unfortunately, the single, cursory paragraph examination of environmental justice issues lumps low income and minority into the same category.

> No disproportionate negative impact on Southern Ute Indian, Hispanic, or other low income communities is expected.

DEIS at 1.7 (emphasis added). Low income communities are quite common throughout the study area and the intensified oil and gas program threatens to diminish the wealth that is held in V-38

(cont)
V-38

the form or land and home ownership.

This "no impact conclusion" is also contrary to information provided in the socioeconomic section that clearly demonstrates that the non-White populations within the study area compose a higher proportion of the general population (19%) than in other areas of Colorado (5-10%)and more than La Plata County Generally (10%). DEIS at Table 3-33. The location of disposal facilities, processing plants, compressors, and other facilities must be analyzed to determine whether these types of facilities are being located in a manner that disproportionately affects non-White or low income communities in the study area.

V-39

Further, the study area was arbitrarily and capriciously expanded to examine employment statistics from a five-county area. DEIS at 3-136. This unsupported alteration in scope of the DEIS hides fact that oil and gas employers hire disproportionate numbers of people from outside the study area, particularly from New Mexico. Comparison of the expanded scope of the socioeconomic section and the minimized scope of the environmental impacts section reveals a thematic defect in the DEIS: manipulation of the scope of this NEPA Process to avoid and hide controversial issues.

V-40

The list of preparers does not reflect any expertise in carrying out an environmental justice analysis. Cultural resources, archeology and traditional economic analyses hardly substitute for persons experienced in carrying out the analysis of the current situation or impacts as they relate to the relatively new field of environmental justice.

V-41

A full analysis of the existing minority and low-income communities is required before a conclusion can be made on whether the impacts are disproportionate. No such analysis exists in this or any other NEPA document that the Alliance or OGAP is aware of.

V-42

Other descriptions are similarly flawed in both scope and detail. The threatened and endangered species descriptions in section 3.3.4.2 rely heavily on the Biological Assessment (BA) in Appendix F. However, Fish and Wildlife Service rejected the BA as being cursory and without adequate information. The lack of reliable and complete information in the description of TES species requires the DEIS to be taken back, completed, and released for comment.

V-43

The current location of wells is presented from 1996 data with a direction that readers obtain the current information from the COGCC. DEIS at 3-47. Approximately 160 wells have been drilled on Tribal land that are not represented on the map. Presenting five year old well location data in a DEIS is inexcusable when the BLM has such easy access to the raw data. It is not enough that the DEIS suggests a place where the information exists. It is the purpose of the NEPA process to present this type of central information about the existing program, not a program that existed five years before release of the DEIS.

V-44

The "confined aquifer theory" presented at DEIS 3-65 has been widely repudiated. It has been widely accepted that the Fruitland formation is in communication with other aquifers, particularly Pictured Cliffs. Further, fissures and other pathways create an interconnected subsurface aquifer with communication between the Fruitland and the surface likely in many places. The lack of formal evaluation of data concerning impacts on surface drainage and runoff patterns near the outcrop is an inexcusable neglect of an important controversy that has surrounded CBM production since it inception. DEIS at 3-66.

V-45

The groundwater contamination analysis continues to drag the red herring of biogenic and thermogenic gas sources as an determinant of the source of methane gas that has contaminated groundwater, drinking water wells and which has been documented to kill off vegetation by completely saturating the soil. DEIS 3-68. Contrary to the theory that biogenic origins suggest non Fruitland methane, "Data from the San Juan Basin in Colorado Provide the

V-46

best evidence for secondary biogenic gas generation." Coalbed Methane, Scientific Environmental and Economic Evaluation, ed. Mastalerz, Kluwer Academic Publishers, 2000, page 95. "Secondary biogenic gases are generated after burial, coalification, and subsequent uplift and erosion along basin margins." Id. Continued reliance on "biogenic" sources to scapegoat local residents for the methane contamination of their own water wells is capricious and must not continue in this DEIS. U-46

Planned uses that were outlined in the Purposes and Needs section of the Final Environmental Impact Statement for the Animas La Plata must be revealed and analyzed in this DEIS. DEIS at 3-93. The purposes of the current reservoir proposal and the plans for increased drilling may conflict or at least require harmonization with the golf courses, residential developments and other activities put forward as the reason for building a dam in Ridges Basin. U-47

Traffic levels are discussed in general background terms and as specific trip volumes by oil and gas activity. DEIS at 3.7. The separate methodologies provide the reader no way to understand the proportion of traffic that is directly related to oil and gas activities. Oil and gas traffic is one of the most controversial aspects of the program, yet the verbose and disjointed descriptions in the DEIS prevent the reader from understanding the amount of traffic generated by the oil and gas program in context of overall traffic levels. U-48

The DEIS claims that because "this EIS is programmatic and specific impact zones are not identified at this time" and thus consultation under the National Historic Preservation Act will not be carried out. DEIS at 3-105. Both premises are arbitrary and capricious. First, the fact that this NEPA process is programmatic heightens the need for expert agencies (State Historic Preservation Officer, Federal Advisory Council on Historic Preservation, Ute Tribes, Other Tribal Governments) to be consulted regarding the direction of the program. Second, the likely location of wells have been identified within specificity of approximately 20 acre spacing windows through orders set out by the COGCC and subsequently adopted by the BLM and Tribe. To say that "impact zones are not identified" is simply false. In order to carry out a lawful NEPA Process, NHPA consultation must be conducted during this NEPA process. U-49

Plain English is sacrificed in the section describing visual impacts. DEIS at 3.9. The description of the small structures provides an example: "The structures are subordinate to the characteristic landscape in foreground views (300 feet to 0.25 mile) and are unnoticeable to the casual observer in middleground (0.25 to 1 mile) and background (1 to 5 miles) views." DEIS at 3-123. Description of larger structures is equally problematic: "Other solid geometric structures such as the meter house, pump jack, condensate tank, on-site water storage tank, and covered produced water pit also are prominent in immediate foreground views, but due to their solid mass they are still noticeable to the casual observer in foreground views." DEIS at 3-123. Visual impacts are a controversial aspect of development that deserves careful attention in the DEIS. The visual impact of "solid geometric structures" can have a concrete result: severely damage home values. Much of the tourist economy of the area depends on scenic viewsheds. The DEIS must be rewritten in a form that the general public and decisionmakers can understand. U-50

The scope of description of the effected environment in the socioeconomic section is limited to economic benefits of the proposed actions. Nowhere are socioeconomic costs of the production activities analyzed. The industry is notorious for touting tax revenues while downplaying impacts during public meetings. It is quite alarming that the DEIS takes the same tone. U-51

The DEIS does identify that development causes unacceptable and illegal noise levels throughout the project area. DEIS at 3.11. The DEIS also recognizes that there is no reasoned U-52

approach to the persistent problem of noise. DEIS at 3-163. However, the DEIS does not acknowledge that the residents hold quiet enjoyment in very high regard. The description of the current situation ignores the loud cries of people who once enjoyed a quiet rural landscape that is being invaded by a cacophony of industrial noises at industrial levels. U-52 (cont.)

The description of hazardous and non-hazardous wastes cannot ignore disclosure and examination of the amounts and types of wastes simply because they are exempt from the Resource Conservation and Recovery Act. The Colorado State Office of the BLM has this information available from other NEPA documents prepared for other oil and gas activities, but for some reason, such detailed information was not included in this EIS. see Attachment 2 (OGAP Comments Submitted to EPA, incorporated in full and reasserted for these NEPA comments) There is no revelation that some companies experienced 145 spills in 2000 and expect over 100 spills in 2001. Other spills and releases that are part of doing business also need to be described in a revised DEIS that is released for public comment. U-53

Pipeline safety is a serious consideration that is not given appropriate attention. The discussion of the legal requirements is helpful. However, the section does not describe the location of existing pipelines, especially in relation to houses. DEIS at 3.11. Describing the existing pipelines infrastructure is a critical feature of the NEPA Process that requires a new DEIS be released for public comment. U-54

The serious issues of gas seeping from the surface and the underground coal fires are glossed over. No mention is made of the need to buy people's homes and tear them down due to gas seeps. These two categories of impacts are serious, controversial, and deserve disclosure and analysis in a new DEIS. It is not enough to simply state: "The SUIT is currently evaluating the characteristics of the fires and options for extinguishing them. County emergency response personnel also have been notified of the locations of the fires." DEIS at 3-174. The characteristics of these fires and the alternatives must be disclosed in this NEPA process. U-55

This NEPA Process cannot be completed with a DEIS that explains away known impacts through a pattern of unproven historical anecdotes, active neglect, and incomplete studies. Real analysis and thorough disclosure of current problems must take place before this NEPA Process is completed and especially before the program is expanded. U-56

Environmental Consequences

The impacts analysis is seriously flawed in both structure and scope. These flaws flow directly from the inadequate range of analysis. However, the inadequacies are compounded by inexplicable deletions of important analyses of even those alternatives that are presented. This is most evident in the cumulative impacts analysis which fails to examine the impacts of Alternatives 1 and 2.

Cumulative Impacts Analysis

There is no cumulative impacts analysis for Alternatives 1 and 2.

Alternative 1 and 2 were not specifically analyzed. U-57

DEIS at 4-6. Instead,

Cumulative impacts, which **consider** the **Agency-and-Tribal-Preferred Alternative in conjunction with other significant future developments** in and near the Study Area, including oil and gas development projects, are summarized **for each environmental resource.** U-57 (cont)

DEIS at 4-1 (emphasis added). In contrast, the NEPA regulations require the EIS to provide

discussions of the environmental effects of alternatives <u>including the proposed action</u>. The comparisons under [the alternatives section] will be based on this discussion.

40 CFR 1502.15(d)(emphasis added). Instead, the DEIS only provides discussion of the proposed action, leaving no possibility for comparison of cumulative impacts across alternatives.

What little cumulative impacts analysis that is provided is cursory, encyclopedic and provides little information. The severance of the cumulative impacts analysis from the resource-based comparison of alternatives renders the analysis inaccessible to most readers and makes both analyses incomplete and for purposes of NEPA. The Air Quality section (DEIS at 4.2) does include a cumulative impacts analysis as part of the assessment of the resource, but unfortunately it is also limited to the preferred alternative. U-58

The complete absence of cumulative effects analysis of two of the three alternatives makes very clear that the DEIS has been reduced to a mere paperwork exercise, designed to rationalize and support the preferred alternative. Compounding the problem, the DEIS lacks analysis of indirect effects. 40CFR 1508.8(b). Despite the identification of numerous significant cumulative impacts (DEIS at 4-280), there is no way for the public or decisionmakers to base a reasoned decision on a comparison of the level of impacts across alternatives. The "hard look" required by NEPA is simply absent.

These comments continue by providing resource-specific comments that correspond to the resource categories used in Chapter 3.

1. **Climate & Air Quality**

Comparison of alternatives cannot be accomplished by simply stating the impacts of the preferred alternatives and concluding the other alternatives "would be less." These are the climate and air quality impacts analyses, in toto for alternatives 1 and 2:

4.2.3 Alternative 1 - Continuation of Present Management

Potential air quality impacts would be less than those described in Section 4.2.5 <u>Alternative 3 -Enhanced Coalbed Methane Recovery</u> below. U-59

4.2.4 Alternative 2 - Coalbed Methane Infill Development

Potential air quality impacts would be less than those described in Section 4.2.5 <u>Alternative 3 -Enhanced Coalbed Methane Recovery</u> below.

DEIS at 4-9. The comparison of impacts needs to be made across alternatives to meet even the basic requirements of NEPA.

Mitigation measures were avoided and delayed under the premise that "the appropriate level of control would be determined and required by the applicable air quality regulatory agencies during the preconstruction permit process." DEIS at 4-22. Unfortunately, many of the facilities considered in the DEIS do not require permitting by any air quality regulatory agency. Similarly, monitoring requirements are absent and the DEIS incorporates statements that "[t]he **Bureau could continue to cooperate** with existing visibility and atmospheric deposition impact monitoring programs" and that "[b]ased upon future recommendations, **operators could be required to cooperate** in the implementation of a coordinated air quality monitoring program." DEIS at 4-25. These statements simply defer the decision to later dates. U-60

If the DEIS and ROD adopt the limited analysis provided here, each APD will thus be required to examine the cumulative impacts of the oil and gas program, perhaps requiring a full EIS for each APD. The tiering concept should be used to make permitting more efficient by adopting appropriate emission mitigation measures with the ability to show need to deviate at the APD stage. U-61

These other aspects must also be considered in a new DEIS:

a. What is the cumulative effect of CBM development on pre-drilling air quality? U-62
b. How much and what percent of the legally allowable emissions does the CBM development create in the area? U-63
c. Identify and quantify the unregulated substances the proposed wells would release into the air. U-64
d. To what extent would the proposed CBM development preclude future emissions by other sources? U-65
e. What is the cumulative impact of CBM emissions on nearby residents? U-66
f. How long do the air quality impacts remain after each impacting phase of production? U-67

2. **Vegetation and Wetlands**

The narrative description of impacts fails to give details on amounts and locations of specific problems associated with noxious weeds and wetlands. But contrary to statements in other parts of the DEIS, the analysis in this section was "[b]ased on estimates of likely locations of wells and right-of-way construction, direct impacts from surface disturbances on vegetation types of the Study Area. . ." DEIS at 4-32. There is no description of how these "likely locations" were located, but it reveals that an inconsistent approach, at best, was used in other parts of the DEIS. The result is that most activities are inappropriately shielded from proper scrutiny. U-68

Like other mitigation measures, those presented for vegetation are generic, lack analysis for efficacy, and are not imposed as requirements. Other issues that need to be addressed include:

a. What has been and what will be the cumulative impact of CBM development on the quantity and severity of noxious and nuisance weeds? U-69
b. Vegetation has been killed by methane seeps and related effects such as saturated and heated soils. What are the current impacts and the predicted impact of reasonably foreseeable CBM development scenarios. U-70
c. What impacts to vegetation from emissions and discharges from each phase of U-71

COMMENT U

V-71 (cont)

production (including illegal dumping of wastes) have occurred.

d. What level of cumulative impacts can be reasonably anticipated to occur across the various development scenarios. V-72

3. **Hazardous Substances**

a. Please reveal and analyze the cumulative effects of the "Hazardous" and "Extremely Hazardous" federally controlled substances that are being used and produced in coalbed methane production in rural-residential areas. V-73

b. What quantities of listed controlled substances and other carcinogens have been and will be released by coalbed methane development -- per well drilled, per year and cumulatively -- in order to drain the formation to the expected total recovery. V-74

c. At 160 acre spacing, what will be the cancer risk and cumulative exposure levels of people and animals to carcinogenic emissions from -- 1) well drilling/completion; 2) well operations including compressors, and 3) well maintenance? V-75

d. The hazardous substances at issue include, but should not be limited to, the following hazardous substances that have been confirmed as potentially utilized or produced during construction, drilling, production, and reclamation operations (Extremely hazardous Substances are bolded): V-76

1,1,1-trichlorothane, 4-4 methylene, 1,2,4-trimethylbenzene, Acetone, Acrylamide, Aluminum, Aluminum Oxide, Ammonium bisulfate, Ammonium hydroxide, Ammonium nitrate Ammonium persulphate, Ammonium sulfate, Arsenic, Barium, Basic zinc carbonate, Benzene, Cadmium, Calcium hydroxide, Carbon disulfide, Carbontetrachloride Chromium, Coal Tar Pitch, Copper, Cumene, Cyclohexene ethylbenzene, Dianiline, Diathonolamine, Dodecylbenxenesolfonic acid, Ethylene diamine tetra, Glycol ethers, formaldehyde, Isobutyl alcohol, Lead, Manganese, Mercury, Methanol, Methyl ethyl ketone, Methyl ter-butyl ether, Nitrogen Dioxide, Nitroloriacetic acid, n-hexane, Napthalene, Nickel, Ozone, PAHs(polynuclear aromatic hydrocarbons), POM (Polycryclic organic matter), Potassium hydroxide, Propolene Radium 226, Selenium, Sodium Hydroxide, Sodium nitrate, Sulfur dioxide, Sulfur trioxide, Tetraethyl lead, Toluene, Uranium, VOC, xylene (m-, o-, & p-), Zinc, Zirconium nitrate, Zirconium sulfate, benzene formaldehyde.

see: Glenwood Springs Resource Area Oil and Gas Leasing DSEIS, June, 1998 Addendum at 15-23; and at L-3.

e. Please disclose the amount of each chemical that is released during each cavitation and during each type of hydraulic fracturing. V-77

f. Please analyze the chemical sensitivity risks, toxic exposure risks and cancer risks for each of the following groups of residents: adult residents who work outside the home, adult residents who work at home, children who attend school outside the home, children who do not attend school outside the home, and workers who spend at least eight hours a day working on and around wells. V-78

4. **Wildlife and Fisheries**

The incomplete analysis that characterizes this DEIS includes disclosure of effects on wildlife. The central feature of coalbed methane production is the removal and disposal of enormous quantities of water from the Fruitland Formation. Yet, the DEIS reveals that: V-79

> The removal of water from the Fruitland Formation could affect some wildlife, particularly if wooded riparian areas are impacted. At this time, **there have been no specific studies of the impact of moving Fruitland Formation water to the Mesa Verde Group** and other places, but have not been formally studied and so cannot be estimated at this time. (sic)

DEIS at 4-42. The lack of study of the impacts to wildlife caused by this central feature of coalbed methane development must be revealed and released in a new DEIS.

Tables 4-9, 4-11 and 4-13 reveal how much impacts will result from the three alternatives. The comparisons are useful in that it reveals that the difference in disturbed acreage between courses of action. For example, Alternative 1 will "disturb" as much as 12.9% of the winter concentration areas while Alternative 3 will disturb a full 33.29% of the elk winter concentration area within the study area. This analysis does lack a comparison to a true "no action" alternative that reveals the amount of impact that would result from continued production from existing wells. Such a comparison is made in Table 4-52, but as described below, the data is not reliable and the source and description of the data is inadequate or omitted from the discussion. V-80

However, the insertion of numbers related to regional range without an analysis of percent impacted distorts the analysis presented in the elk and deer tables. The regional range numbers form an important component of a cumulative impact analysis that reveals how much of the regional summering and wintering areas are already impacted by oil and gas and other activities. Unfortunately, they are presented out of context in a manner that minimizes the level of impacts on elk and deer habitat by oil and gas and other activities throughout the region. The arbitrary inclusion of total habitat in the area must be accompanied by an analysis of the level of current and reasonably foreseeable impacts for the regional habitat. V-81

Again, the Elk and Deer analysis is based upon estimates of likely locations of proposed well pads, roads and pipelines." DEIS at 4-42. These types of estimates need to be refined and based on better data, but their use here shows that it is not necessary to apply study area-wide assumptions that ignore the actual situation. V-82

The reasonable range of mitigation measures for wildlife have never been fully revealed in a NEPA document that has met public scrutiny. This DEIS cannot rely upon a decade old Environmental Assessment that federal agencies acknowledge is insufficient and out of date. V-83

In addition to analysis of the effects on elk and deer habitat, the following issues need to be addressed:

a. Address the issue of habitat fragmentation from doubling the number of wells, well pads, and access roads for wildlife (game and non-game) species. V-84

b. How many additional elk will die in: a mild winter, an average winter, a severe winter? This question is based on the statement that "level of disturbance plays a critical role in over winter survival for elk and deer?" DEIS 4-43 V-85

c. How will the stability and size of the regional elk herd be impacted by denser conventional gas and CBM development? U-86

d. How will the stability and size of the regional deer herd be impacted by denser conventional gas and CBM development? U-87

e. How will the migratory bird species that use the study area be impacted by denser conventional gas and CBM development? U-88

f. Describe how this NEPA process satisfies requirements of the Migratory Bird Treaty Act and if it does not, please release a new DEIS that does. U-89

g. Describe the cumulative effects of dispersed industrial development of CBM on the various ecosystem types. U-90

h. What are the cumulative impacts of CBM development on the interrelationship and interdependence among ecosystem types. U-91

5. **Threatened and Endangered Species**

The DEIS indicates that "[t]he BLM is engaged in formal consultation with the USFWS regarding potential impacts from oil and gas development activities on the Reservation." DEIS at 4-44. The DEIS does properly recognize consultation is required at both the programmatic and the site specific levels. DEIS at 4-61. However, the BA that was published in this DEIS was returned to BLM because it lacked the information required for FWS to begin consultation. Similarly, the BLM should withdraw this DEIS and present the public with a complete, useful and legal DEIS. U-92

The data presented in Table 4-52 that analyzes disturbance to biological resources is not compatible with the numbers presented in Table 4-8 through Table 4-13 that discuss impacts on deer and elk habitat. While the numbers cannot be reconciled based on information in the DEIS, it becomes apparent that the impacts on Bald Eagle habitat has been grossly underestimated by reliance on acreage data that approximate vegetative removal numbers and not actual impacts to the species and its use of habitat. Tables 4-14 through 4-16 also presents an analysis that is based upon denuded acreage, not the actual area impacted by the activity. U-93

The analysis of cumulative impacts to biological resources and TES species must extend past an analysis of those areas that will be denuded by oil and gas development. It must extend to those areas affected by oil and gas development as is properly done in Tables 4-9, 4-11 and 4-13. Anything less avoids disclosure of impacts. In the NEPA context this is not allowed. In the context of the Endangered Species Act, such omissions could result in illegal harm to protected animals or fish. U-94

The "significance" criteria for TES species would allow various forms of illegal "take" to occur without a finding of significance in this DEIS. By definition, section 9 of the ESA prohibits "take" of a species. By not complying with the section 7 duty to consult, the agencies are also violating section 9's "take" prohibition. Under section 9 of the ESA, it is unlawful for anyone to "take" a threatened or endangered species of fish or wildlife. 16 U.S.C. § 1538(a)(1)(B) & (G). Congress broadly defined "take" in the ESA to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect." 16 U.S.C. § 1532(19). The term "harm" is further defined to include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." 50 C.F.R. § 17.3; Babbitt v. Sweet Home Chapter of Communities for a Greater Oregon, 515 U.S. 687, 706 (1995). This prohibition extends to threatened species as U-95

well. 16 U.S.C. § 1538(a)(1)(G); 50 C.F.R. § 17.31(a). Courts have held that future injury to a protected species constitutes "take." An imminent threat of harm to a listed species is a violation of section 9 of the ESA. Yet, the DEIS only characterizes a direct loss of individuals or critical habitat as significant. U-95 (Cont)

In response to a recent FOIA request, the BLM revealed that no section 7 consultation has been prepared for the San Juan Resource Area's coalbed methane program. Attachment 3 at page 3, #8. (BLM Response to Alliance FOIA Request). It is quite likely that "take"has been committed by employees in the Durango BLM Office by knowingly issuing permits that have not been subject to ESA consultation requirements, permits which likely result in section 9 "take" of protected species. U-96

The question of whether or not any responsible persons will be held civilly or criminally liable for ESA violations is beyond the scope of this DEIS. However, the questions of whether issuance of illegal permits will cease and whether the oil and gas program will comply with the ESA are appropriate questions. Based on the following statement in the DEIS, it appears that the oil and gas program will continue to violate the Endangered Species Act: U-97

> Current BIA and Tribal standard conditions of approval are designed to protect federal threatened and endangered species by not allowing actions that would result in a "jeopardy opinion" under Section 7 of the ESA.

DEIS at 4-76. Designing conditions of approval to avoid a "jeopardy opinion" is not enough.

Once the FWS lists a species as threatened or endangered, all federal agencies have an **affirmative duty to carry out programs for the recovery** of those listed species. Section 7(a)(1) provides in relevant part: U-98

> [A]ll other federal agencies shall in consultation with and with the assistance of the Secretary, utilize their authorities in the furtherance of the purposes of this chapter by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 1533 of this title.

16 U.S.C. § 1536(a)(1)(emphasis added). Through the ESA, Congress intended to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved [and] to provide a program for the conservation of such endangered species and threatened species." 16 U.S.C. § 1531(b). The ESA defines "conservation" as "to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this chapter are no longer necessary." 16 U.S.C. § 1532(3); Carson-Truckee Water Conservancy Dist. v. Clark, 741 F.2d 257, 261-62 & n. 3 (9th Cir. 1984). Because the DEIS is void of evidence of any attempt to fashion approvals and actions to promote conservation or recovery efforts, the oil and gas program under scrutiny in this DEIS also violates section 7(a)(1) of the ESA.

The following questions related to TES must be addressed:

a. What is the cumulative impact of: a) selenium levels, including selenium contributed by road dust and erosion; and 2) each of other hazardous substances emitted or discharged. U-99

b. FWS has documented that heightened selenium levels have caused cross-beak U-100

birth defects in southwestern willow flycatchers in Colorado. Have these impacts been researched here? U-100 (cont)

c. Southwestern willow flycatchers have been documented in the study area, but the DEIS does not reveal this information. The lack of revelation must be corrected and full surveys must be conducted. U-101

d. How are to the endangered and threatened fish, mammal and bird species that depend on the riverine habitats downstream from CBM development impacted, 1) by water use, 2) by increased water pollution? U-102

e. What steps are being taken to recognize and avoid impact impacts due to instream depletions? Are any of these steps mandated? U-103

f. Describe how CBM development can aggravate the condition of the local species and those downstream that have been identified as struggling or at risk of requiring protections provided by listing as threatened or endangered. U-104

g. What is the impact on known and potential southwestern willow flycatcher and eagle roosts, habitat, breeding, and nesting sites from die-off of cottonwood-willow riparian habitat that is directly and indirectly caused by oil and gas development. U-105

h. Will the responsible agencies consult with the Fish and Wildlife Service to ensure that the decision on the application is consistent with the Endangered Species Act, especially sections 7 and 9? U-106

6. **Geology and Minerals**

The time frame of the study does not match the time frame of the program. Table 4-17 reveals the amount of gas that will be produced during the next 20 years. This arbitrary cutoff ignores the fact that once drilled, wells are expected to be in place for 30-40 years at which time, the wells will presumably be abandoned, plugged and the area fully reclaimed. The analysis of the impacts on geology and minerals requires that the DEIS disclose the amount of gas production over the full life of the project. The failure to include this data renders the analysis in the DEIS arbitrary. Since the BLM knows that no additional gas will be recovered, only that recovery time will be accelerated (Attachment 1) the preparation of this section appears openly capricious, designed to justify decisions already made to intensify and accelerate production without full disclosure of the consequences. U-107

This DEIS fails to seriously address hydrogen sulfide potential by merely suggesting that a monitoring program will be put in place. DEIS at 4-79. Hydrogen sulfide is a deadly gas, one of the most deadly gases associated with oil and gas development. An analysis of all injuries and deaths that have been associated with hydrogen sulfide must also be included. The extent of hydrogen sulfide seeps that have been documented, that are suspected, or that are reasonable foreseeable must be presented in a new DEIS that is then released for public comment. U-108

Loss of coal resources has been documented from underground coal fires that the Southern Ute Tribe has been unable to extinguish. Cursory mention of data from 1995 and revelation that for three new fires, "no estimates have been made of the extent of the fires," are not a sufficiently serious examination of a serious problem. DEIS at 4-81. The statement that the "Tribe is working with a consultant to put out the fires" DEIS at 4-81 is simply not sufficient and contradicts public statement that the Tribe's actual efforts to put out the fires have been unsuccessful and have been halted. U-109

The lack of study and information presented in the DEIS is contrary to the fact that these coal fires have been a serious concern for years. The cause of the fires have also been "under investigation" for years. The lack of completed studies is indicative of the experimental nature of coalbed methane development. Without completed studies on serious geological problems, expansion at this time is simply irresponsible and uninformed. NEPA may not prohibit irresponsible decisions, but uninformed decisionmaking is exactly what the current NEPA process must eliminate. Dependence on the industry-conducted 3-M project does not provide the independent analysis that is required under NEPA. The DEIS's heavy reliance on the industry-conducted 3-M Study also runs afoul of the NEPA contracting regulations. 40 CFR1506.5(c). U-109 (cont) U-110

a. The Speed of Depletion is a crucial economic consideration that must be studied and revealed : U-111

i. What are the economic benefits of delaying recovery in light of likely future hydrocarbon fuels shortages that will likely increase prices of CBM over the next 50 years of expected natural gas supply availability? U-112

ii. Describe the full production projections of the program especially the time expected to reach abandonment pressures and the amount of gas that will be recovered under each alternative and a new "no more wells" alternative. U-113

iii. By how much will accelerated removal of water from the coalbeds cause poorly understood sub-surface ecosystem changes. U-114

iv. How will accelerated desorption and migration of methane gas from the coal impact the amount of gas ultimately recoverable from the coal seam. U-115

v. What subsurface ecosystem changes will occur in each geological formation due to CBM development? U-116

7. Soils

As with many of the other impacts, deferral of full NEPA study until the APD stage should be anticipated to result in full and careful on-site examination of soil type and impacts. Supplemental programmatic EISs will be required from time to time as such data collection reveal cumulative impacts that are were not subjected to full NEPA analysis in this document. Such foreseeable future delays could be avoided at this stage by doing the required soils field work and analysis in a new programmatic DEIS that is released for public comment. U-117

For those fortunate few that were provided with maps, Map 14 does clearly display that the areas of high to severe erosion potential are distributed widely throughout the study area and that this information is not conveyed in the text on 4-88. The heavy concentrations in the southwest corner, and especially surrounding the Animas River near Bondad are of critical concern due to the increase in disturbed soil and contaminated soil runoff into the Animas River. U-118

The DEIS does not compare impacts to soil that result from various alternative mitigation that reduce the amount of disturbed soil. These measures include requiring standards and guidelines that address: 1) minimum ground disturbance; 2) the maximum interim reclamation; 3) construction methods; 4) reclamation methods, and 5)other measures designed to protect and conserve soils in the area. No impacts are anticipated based on " an approved reclamation plan" but the DEIS does not disclose what such a plan would look like. DEIS at 4-92. U-119

The use of an unsupported 5% urban development loss for prime farmland from other U-120

portions of Colorado as a significance trigger is arbitrary. DEIS at 4-95. The industry has often compared its impacts to urban sprawl as a political tactic. The use of such a comparison in a rural area has no demonstrated use and appears to be taken directly from the industry's lobbying messages. V-120 (cont)

In addition to the concerns that received a glance instead of the required "hard look" the following soil and agricultural impacts need to be addressed in a new DEIS that is released for public scrutiny:

a. Describe likely and proven causes of known methane-saturated soil and the long term cumulative effect on affected soils of various levels of methane (and other CBM substance) contamination. V-121

b. What amount of topsoil will be contaminated by production related activities? V-122

c. How will irrigated soils downstream from CBM production be affected by CBM wastes that are released to the air and water and find their way back into the irrigation water supply? V-123

d. Since there is a history of illegal dumping, what are the residual impacts of past and foreseeable legal and illegal dumping and releases. V-124

e. What is the quantity of topsoil that has been and that will be lost to erosion related to construction and 50 years of operations of well pads, roads and other related oil and gas activities? V-125

f. What additional mitigation measures that will be required for areas of high and severe erosion that were identified in the DEIS? V-126

g. Estimate the number of acres that have been and will be impacted or will be removed from livestock grazing, other agricultural uses, and gardening uses due to well pads, roads, methane saturated soils, and other aspects of infill drilling. V-127

h. How many acres of federal public lands would the wells being considered in the application denude? V-128

i. Organic farming, personal use gardening, and production for local distribution through farmers markets is ongoing and is growing importance in the local area. Describe the effect of CBM production on the availability of lands for use in household gardens and commercial production of certified organic foods. V-129

8. **Water**

The cursory discussion of impacts of hydraulic fracturing are without any support or data. (DEIS at 4-98). The single paragraph that discusses the impacts of hydrofracturing downplay the serious and often undisclosed nature of fracturing fluids. The BLM has released a summary of materials used during fracturing processes. See Attachment 2. Further, like most other processes, many different alternative fracturing packages exist. Halliburton, one of the most prolific fracing companies provides a range of "products" some of which are touted to reduce environmental impacts. According to Halliburton: V-130 V-131

Data used to determine the appropriate fluid system includes:

- Friction pressure determination of the various fluid systems
- Fluid rheology at a variety of temperatures
- Conductivity for the various fluid systems

- Compatibility of the fluid with the formation
- Compatibility of the fluid with the components
- Environmental properties of the fluid systems
- Gel break properties and conditions

Attachment 4 (Halliburton Web Document). No such data, nor even the mention that this type of data may be important, is included in the DEIS. It is quite likely that the responsible federal agencies have never given the hydraulic fracturing process a "hard look." U-131 (cont)

The Halliburton advertisement confirms that the range of materials that may be included in the fracturing fluids is extensive. The online Halliburton ad describes the "complete line of fluid system additives for use during fracturing. . ." see Attachment 4 at page 3. Although one of the leading industry providers of field services touts the need to analyze a wide range of alternatives depending on system used and formation encountered, the DEIS contains no examination of the industry-professed range of alternatives, although such impacts analysis is required by law. A new DEIS must be released for comment that discloses and analyzes the range of alternatives and impacts that area associated with hydraulic fracturing.

Similarly, the disclosure of impacts related to cavitation is lacking and even absent. The lack of real disclosure and analysis is evinced by the attachment of an addendum from a New Mexico Environmental Assessment concerning cavitation at Appendix O. Such summary revelation does not satisfy the "hard look" required by NEPA. U-132

There has been some indication that field service operators are pursuing a hybrid between hydraulic fracturing and cavitation. If this is occurring, it must be revealed in this NEPA process.

The DEIS simultaneously describes and downplays the possibility that water will be impacted by poorly designed wells, poorly completed cement jobs, mechanically unsound wells, old wells, and poorly constructed cathodic protection wells. DEIS at 4-98,99 The descriptions of the foreseeable problems and the severity of impacts, should they occur, is not revealed. U-133 Instead, the DEIS hides the type and intensity of potential problems behind a veil of bureaucratic doublespeak: "However, as impact would occur only if the governing regulators (federal agencies or COGCC) failed to protect the resource, the impact is not quantifiable." DEIS at 4-99. The federal agencies simply cannot move forward under the arbitrary and capricious presumption that underfunded and understaffed agencies will somehow "protect the resource." This is especially serious since the COGCC has moved resources from inspection and enforcement and toward permitting and drilling workloads. Attachment 5 (Excerpt of COGCC Monthly Report). U-134 The NEPA process is designed to force agencies to reveal the activities and impacts that are being proposed. This DEIS does not reveal such impacts.

Industry representatives have testified under oath before the COGCC that disposal of produced water from additional wells will outstrip current injection well capacity. This directly contradicts the statement in the DEIS at 4-101 that no new disposal wells will be needed. It also ignores the fact that industry continues to apply for new disposal wells on fee lands. U-135

No mention is made that water disposed in the Simon Land and Cattle disposal well has been shown to cause water seeps at the Hickerson Hot Springs. This serious problem of disposed water causing formation water to surface nine miles away in the Animas Valley must be revealed and considered. U-136

Further, EPA has brought enforcement actions against operators for overpressurizing and overfilling disposal wells in the region. The environmental consequences of overfilling and U-137

overpressurizing must be revealed One problem of overpressurization is that additional fractures may be created by disposal wells. It is quite possible that the theoretical disposal characteristics simply do not exist or have been altered by 15 years of experimental and sometimes illegal operations. U-137 (cont)

Abandonment may present "little potential" for contamination, but it is the purpose of the DEIS to describe such potential and the impacts involved. DEIS at 4-108. Similarly, the comparison of alternatives does little to reveal differential impacts of drilling additional wells. The DEIS merely states that "it is assumed that the potential impact on groundwater resources would be slightly greater than under Alternative 1." DEIS at 4-108. The DEIS must reveal, not assume, the differences in impacts across alternatives. U-138

The analysis of nitrogen and carbon dioxide injection does recognize that fracturing is a possibility, DEIS at 4-109, yet the DEIS does not reveal how injection pressures will be regulated or monitored to ensure that these injection processes will not result in undesired formation and near-formation fracturing. U-139

The impacts summary relies upon personal communications for measurable data and on 3M model runs that were expected to be carried out in 2000, before the release of the DEIS. For example, the basis for the Janowaick calculations, not personal communications with the authors, must be revealed in the DEIS so that the basis for the assumptions and analyses can be understood and examined if necessary. DEIS at 4-111. U-140

The mitigation measures for water do include some measurable detail, but since the impacts analysis lacks any such detail, it is impossible to determine the sufficiency of the mitigation measures. Again, there is no indication whether and when these mitigation measures would be implemented. U-141

These or issues related to groundwater have not been addressed in the DEIS and require specific attention:

a. Reveal and analyze the independent reservoir engineering studies that support the industry and agency conclusions that each formations' capacity to accept additional produced water had been/would be exceeded. U-142

b. Describe the depletion/recharge dynamics for the coal formation over a time-frame that includes full groundwater recharge after CBM development is completed. U-143

9. **Surface Water**

Stormwater discharges from well pads and roads are identified as "potential impacts" but the type and intensity of these "potential impacts" are not disclosed. EIS at 4-117-118. The sedimentation and contamination of rivers and streams is a major problem that requires serious scrutiny. U-144

Amounts of water use are examined in some detail, but the DEIS does not delve into the associated impacts on area fish and wildlife, irrigation users, and area water bodies. The DEIS only characterizes the uses as small "relative to perennial stream flow in the basin." DEIS at 4-119. The localized and cumulative impacts of water use according to actual current sources and relative to actual impacts must be revealed. Foreseeable sources and impacts must also be included in a DEIS that meets NEPA requirements. U-145

Evaporation ponds are identified as a method for disposing of produced water, but there U-146

is no analysis of the impacts that result from evaporating water that is not clean enough for direct disposal. DEIS at 4-121. What contaminants are released during evaporation process that disposes water into the air where that water is too contaminated for direct stream disposal? What becomes of the contaminants that evaporate with the water? What is eventually done with the contaminants that remain in the evaporation pit? U-146 (cont)

Further, these following issues and questions need to be addressed:

a. Quantify the increased sediment and chemical runoff for all aspects of production including the effects of pits, produced water, run-off from pads, erosion due to roads, and vegetation impacts. U-147

b. What amount of what pollutants does CBM contribute to the downstream river systems? U-148

c. What effects do the pollutants created by CBM production and operations have on the quality of surface waters? U-149

d. Have any CBM operator violations in the United States resulted in diminished water quality? If so, please describe the incidents. U-150

e. Are the state and federal enforcement mechanisms sufficient to prevent, discover and prosecute illegal activities related to increased well densities? U-151

f. Are there any unpublished studies, especially any studies done by the Bureau of Land Management, that suggest that river flows may be affected by dewatering the formation? U-152

g. How are the Animas, Florida, Pine, Piedra, La Plata, and San Juan Rivers being affected by oil and gas operations? U-153

h. What are the "best management practices" that will protect surface water quality and quantity? U-154

10. **Drinking Water**

In addition to the passing mention of drinking water in the ground water and surface water analysis, the impacts to drinking water need to be analyzed separately and distinctly. Such analysis must consider the following:

a. What are the results of monitoring/tracking water quality trending in known contaminated drinking water wells? U-155

b. Describe the dynamics of groundwater recharge on drinking water quantity and quality, (esp. when depleted by CBM development), for each geologic formation commonly used for domestic water by residents. U-156

c. Describe those aquifers that are currently draining into the Fruitland Formation. U-157

11. **Land Use and Ownership**

In contrast to other analyses that provide general statements with no quantification, the analyses of land impacts relies almost entirely on numbers with no general or specific analysis of impacts. And, similar to some of the analyses of wildlife, the impacts are limited to those areas that are denuded or occupied by oil and gas operations. This section provides little to no information for the public and the decisionmakers to understand the impacts of the various alternatives. The following must be addressed and open for public comment during this NEPA process: U-158

a. In what manner will the industrial character of oil and gas development change U-159

V-159 (cont)

the rural quality of life in the project area?

b. What are the specific impacts on rural quality of life that are unavoidable? DEIS 4-158. V-160

c. What is the cumulative effect on real estate prices in areas where CBM wells have been drilled? Please examine using sensitivity analyses that include distance from well, visibility, amount of vegetation, and noise barriers among other factors. V-161

d. What are the cumulative effects on real estate prices in areas subject to CBM development due to stigmatization of rural communities as dispersed industrial zones where surface owners have little legal or regulatory protection? V-162

e. Using accepted economic methods, please disclose the whether increased well densities are economic in relation to land use impacts and environmental damage. V-163

f. Please disclose all economic impacts of increased well drilling. V-164

12. **Recreation**

The economy of the region is heavily dependent on tourism. Local residents identify recreation as one of the most attractive aspects of living in the area. The fact that no designated recreation area will be drilled does not reveal the type and intensity of impacts. The impacts on the following aspects of recreation must be addressed:

a. What are the direct and cumulative impacts of all reasonable alternatives on the types of recreation engaged in by residents? V-165

b. What are the direct and cumulative impacts of all reasonable alternatives on visitor recreation, including economic impacts? V-166

c. What are the direct and cumulative impacts of all reasonable alternatives on development on hunting and fishing? V-167

13. **Transportation**

The transportation analysis is of little to no practical value because it assumes increased traffic will occur evenly throughout the study area and the study period. As discussed in other portions of the DEIS, the area is not homogeneous, but ranges from dirt roads with low maintenance standards to paved United States highways. Impacts that are negligible on US Route 550 can be devastating when they occur on a single stretch of dirt road. There is no disclosure of the serious impacts faced by the Town of Ignacio caused by a heavy concentration of oil and gas traffic through the middle of town. U-168

Even though the DEIS anticipates that some of the bridges will not accommodate the overweight drilling units, neither the weight of such drilling rigs nor the location of such bridges are disclosed. DEIS at 4-162. Such foreseeable impacts must be revealed in this NEPA process. U-169

The reliance on numbers and statistics conceal the qualitative impacts on people and the area roads. The public and decisionmakers must be informed of both the actual impacts and the scope of the impacts. A mix of numbers and narrative is essential to full disclosure. The transportation section is a good example of where this DEIS uses one at the exclusion of the other, resulting in dozens of pages of uninformative text that reduce this NEPA process to a mere paperwork exercise. The following issues are among those that must be revealed in this NEPA process:

a. A comprehensive review of road impacts, including secondary effects is needed to understand the cumulative impacts of the proposed CBM development on the roads and residents and should include: U-170
   i. Engineering review of projected impacts of "typical" CBM vehicles & traffic as measured on a variety of roads types and locations.
   ii. Correlation of road use-related revenues to anticipated operation, maintenance and repair costs.

b. What further reviews (and conclusions) have been completed re: total generation of fugitive dust on unpaved roads. U-171

c. What are the results from studies that have gauged and quantified fugitive dust impacts to date and how would the operation and maintenance of the proposed wells aggravate existing problems. U-172

d. What are the results/conclusions of previous fugitive dust measurements and: U-173
   i. What determinations have been arrived at related to compliance with Clean Air Act (PM-10, PM2.5, haze, etc.) and Clean Water Act - and how have those conclusions been verified?
   ii. What policies, regulations and/or agency oversight have been implemented to mitigate these impacts - and with what quantified/verifiable results to date?

e. What are the impacts of CBM vehicular traffic on "highway" safety? State how the statistical conclusions have been verified as relevant to the actual condition in the study area.. U-174

14. **Cultural Resources**

Most of the ground disturbance for the preferred alternative will occur in areas of

moderate to high sensitivity and would impact an estimated 179 sites. DEIS at 4-176. The DEIS proper reveals that "[t]he available inventory data indicate that no cultural resources within the Study Area have actually been listed on the National Register, but many are undoubtedly eligible." and that "It may be impossible to completely avoid all cultural or historic properties regardless of which alternative is selected. . ." DEIS at 4-170. Yet, these foreseeable impacts are characterized as insignificant, presumably because they are only a small portion of the rich archeological "regional resource base." DEIS at 4-176. The arbitrary variation of the scope of the study to a unstated "regional" area renders the conclusions capricious, at best. U-175

Impacts to cultural resources cannot be fully disclosed until the oil and gas program is subjected to consultation and scrutiny under the National Historic Preservation Act and other applicable laws. Measures for avoidance of impacts to important historical values and their context must be done now while program-level alternatives remain open that will likely not be available at the project specific level. Even if alternatives remain available, unpredicted project delay may be caused while alternatives are preserved during a supplemental EIS process that considers cumulative impacts. U-176

15. Visual Resources

The visual resources section is generic and does not provide useful information on the impacts of the current project. The methodology relies entirely upon a mathematic model that is not useful in understanding anticipated impacts on actual characteristics of the area. U-177 The following must be revealed in this NEPA process:

a. Evaluate the direct, indirect, and cumulative impacts of proposed CBM operations on rural communities according to the visual sensitivity of the residents. U-178

b. What is the direct, indirect, and cumulative impact of flaring on nearby residents and on the viewsheds? U-179

c. What are the direct, indirect, and cumulative impacts of CBM on the tourist experience? U-180

d. How long will visual impacts remain after abandonment pressures are reached? U-181

e. What are the cumulative effect of proposed CBM development on federal and state visual resource standards and objectives? U-182

f. What are the cumulative impacts of proposed CBM development on the viewsheds from various recreation use categories of federal public lands, including concentrated developed, dispersed roaded, backcountry, and wilderness? U-183

16. Social and Economic Effects

All economic determinations must include consideration of the health, safety, welfare, and environmental costs and impacts caused by increased development. Merely considering selected financial and economic benefits of drilling and operations ignores and violates requirements to ensure production is carried out economically and in the public interest. Economic costs are totally absent from the economic analysis. U-184

The DEIS relies upon outdated estimates, especially a flat gas price of $2.00/mcf, that may have been reasonable in 1997, but which were outdated at the time this DEIS was released U-185

in 2001. The boom/bust nature of energy development that is reflected in the obsolete economic assumptions must also be taken into account. The following must be included in this NEPA process: V-185 (cont)

a. The spacing and the actual drilling of a gas well has real and perceived impacts on the rural character and on the quality of life of residents. Either type of impact has real effects on social and economic values that must be considered, including:
   i. Pride in the neighborhood community and security in one's home are important factors to determine well-being. How much impact on social services (crime control, welfare, counseling, mental health services) is expected as a result of creating industrialization in rural neighborhoods and destroying the security people feel in controlling their homes.
   ii. Investment in a home that is often the most significant investment a resident will make in his or her life. By how much will real estate subject to development of the formation deteriorate in value (or deviate from upward trends) by alternative?

V-186

b. The effect on La Plata County, SUIT, and Colorado tax revenues must be analyzed.
   i. What will be the cumulative impacts as a portion of the tax base of accelerated recovery on County and State tax revenues over the next 50 years assuming constant tax rates and an reasonable range of increased gas price scenarios. That is, how does accelerated development exacerbate boom and bust nature of oil and gas development?
   ii. What will be the affect of CBM development on property tax collections within the lands affected by development of the formation, including those lands along the outcrop.

V-187

17. **Noise**

Noise is one of the most often complained about impacts. Doctors and area residents have testified under oath that serious health effects are caused by excessive and uncontrolled variations in noise caused by oil and gas operations. COGCC hearing transcripts of June 2000. The DEIS does not investigate or reveal these serious health threats and affects. Instead, these noise impacts are presented as "annoyances" that are handled on a case by case basis. Electing to handle noise sources on a case by case basis does not alleviate the need to reveal the range of direct human health impacts of noise. Whether annoying or harmful, the impacts of noise must be revealed in this NEPA process.

V-188

18. **Explosions**

Wells, pipelines and all types of facilities have the potential to explode and cause great death and destruction. The explosion impacts and their likelihood must be revealed in this NEPA process, including the following:

a. Several recent news reports have detailed death and destruction that can result from explosions related to oil and gas development. V-189

b. Please statistically estimate, based on industry averages, the expected number of deaths, explosions, injuries, etc. that will be caused by CBM development.] U-190

c. Please estimate the number of people who are at risk of injury or death should any one or a number of CBM facilities explode.] U-191

d. Please describe the various explosion risks and their likelihood based on historical industry averages.] U-192

Conclusion

The Draft Environmental Impact Statement for Oil and Gas Development on the Southern Ute Indian Reservation has failed to demonstrate that expanded drilling is necessary to achieve efficient and economic development of oil and gas resources. Expansion without explanation would violate federal law and various trust responsibilities of the federal government. Even assuming that more wells or new enhancement procedures were necessary, the DEIS does not provide the information necessary to make a reasoned decision whether or not the expansion is worth the damage to people and the environment. Even where such information is provided, it is provided in a manner that is inaccessible to most, sometimes all, readers. The DEIS simply does not satisfy even the most basic requirements of NEPA. The Alliance requests that the responsible agencies rework this DEIS into a document that reveals alternatives and impacts, informs the public, and provides decisionmakers with a full range of alternative courses of action to help guide the oil and gas program.

Sincerely,

Mark Pearson
Director
San Juan Citizens Alliance

Gwen Lachelt
Director
Oil and Gas Accountability Project

enriched due to leaching from organics in the overlying and underlying organic-rich shales.

In summary, iodine age dates should not be used to constrain water residence time in the San Juan Basin.

E. Radioisotope Geochemistry – Tritium Analyses

Six samples of produced water were submitted for tritium analyses, along with one sample of water from the Pine River. Table 2 is a summary of the tritium results. The results indicate that the Enervest 12U-2 (Figure 16) contains highly enriched tritium (134 Tritium Units), even higher than the background tritium in today's precipitation. This indicates that the water produced by the 12U-2 well has been isolated from the atmosphere since the 1950's H-bomb testing and shows the peak bomb-derived tritium.

The Enervest 12U-2 is located approximately 0.75 miles from the coal bed outcrop. It has produced approximately 700,000 barrels of water since 1992, and continues to produce water at a relatively high rate.

The sample from the Pine River did not contain any measurable tritium. An explanation for this apparently anomalous result is that the sample was collected during the winter, under low flow conditions. The Pine River is fed by aquifer discharge along the alluvial valley, and it is likely that the majority of the water in the river under these conditions is aquifer discharge. Because the recharge areas are up to several miles from the discharge point, it is possible that the water in the Pine River under base flow conditions is dominated by recharge water over 60 years old. Another explanation is that today's precipitation is too depleted in tritium in this region to contain a signature from H-bomb testing. Additional surface water samples are being analyzed to confirm background tritium in recent precipitation.

The tritium analyses constrain groundwater flow velocities to about 80-100 ft/yr in the Indian Creek area. It further indicates that wells such as the Dulin D-1, Evelyn Payne 1A and other sampled wells are not producing water younger than about 55 years old.

Alternatively, the tritium-depleted water in the Pine River may indicate that the Dulin D-1 and others are producing water that is less than several years old.

VI. Coal Bed Methane Well Hydraulics

A simplistic analytical model was developed to evaluate drawdown away from a coal bed methane well under equilibrium conditions, or long-term pumping. Typical conditions were defined as 0.1 md permeability to allow for relative permeability effects, water production is 10 barrels/day, operating well pressure is 300 psi, and well radius is 5 feet (cavitated well). The analysis indicates that a typical well will decrease reservoir pressures approximately 225 psi (520 feet of head) at a distance of 1,000 feet from a coal bed methane well (Figure 17). This is insufficient pressure depletion to recover the available methane, and denser well spacing is required under typical conditions.

he analysis indicates that well spacing on 320 acres (approximately 3,900 feet between wells) is oo far apart to optimally recover the gas. The infill well spacing of 160 acres will recover the gas over a 20 to 40 year period, whereas the 320 acre spacing would require 100+ years to recover the same amount of gas. It should be noted that the operators are not likely to operate wells for 100+ years because replacement costs, added compression equipment, and maintenance costs will increase as production decreases. Eventually, the operators rate of return is too low continue operations and the wells would be plugged and abandoned with significant quantities of gas left in the reservoir.

3M reservoir modeling also indicates that the targeted abandonment pressures are not likely to be reached by extraction from the 320-acre spaced wells in a reasonable time period. Infill wells will achieve optimal recovery over large regions of the basin.

VII. Coal Bed Methane Development Effects on Basin Hydrology

Sufficient evidence exists to conclude that associated CBM water production has been decreasing water levels at the outcrop because the CBM withdrawals are significantly greater than the recharge potential. Recharge along the Fruitland Formation is on the order of 1 to 10% of the Mean Annual Precipitation (MAP). This is inferred from other studies in the region (Whitfield, et. al., 1983 and Weir, et. al., 1983) and from the calibrated 3M hydrology model. The AHA model estimates total recharge potential from the Fruitland to the entire San Juan Basin to be approximately 280 acre-ft/yr, with the vast majority of recharge occurring in the northern San Juan Basin.

While it is likely that some minor areas of the outcrop may not be in good communication with downdip areas, the vast majority of data collected to date indicate a high degree of hydraulic communication between the outcrop and the basin.

The hydraulic interconnection between the basin rim aquifers and CBM wells is documented by the following:

1. Production well interference testing conducted in wells located in the Pine River Valley near the Fruitland subcrop. These tests indicate that the radius of influence in CBM wells can exceed 4,000 feet.
2. Very large (>150 feet) hydrostatic head decreases in monitoring wells located between the outcrop and production wells in the Valencia Canyon area. These head decreases are coincident with the onset of CBM development.
3. Hydraulic head decreases up to several tens of feet in monitoring wells in the Pine River Valley.
4. Water level decreases at shallow domestic Fruitland Formation wells at Valencia Canyon and Texas Creek.
5. Statistically verifiable increasing trends in methane concentrations along the outcrop coincident with CBM development.
6. The drying of Soda Springs.

ATTACHMENT #2
SJCA/OGAP Joint Comments
SUIT DEIS

Citizens Oil & Gas Support Cei

a project of San Juan Citizens Alliance

August 28, 2000
VIA FAX AND MAIL

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Dear Mr. Kobelski and Ms. Cronkhite,

On behalf of the Citizens Oil & Gas Support Center and the organizations named below, thank you for the opportunity to comment on the design of the study to determine the environmental risks associated with hydraulic fracturing of coalbeds for methane production. We are also appreciative of your recent visit to Durango, Colorado, to meet with residents affected by coalbed methane development, and to witness a hydraulic fracturing operation.

These comments are provided to assist you in designing a study that reveals the full extent of the adverse impacts, threats, risks, and potential environmental impacts of hydraulic fracturing. The Citizens Oil & Gas Support Center is especially grateful to seethe Environmental Protection Agency (EPA) launch a study into the seemingly secretive world of fracturing subsurface resources.

Since various forms of fracturing a geologic target have been used widely throughout the oil and gas industry, considerable information must exist on this common industry practice. However, the impacts of this practice have been downplayed and even obfuscated by state regulators and industry groups. For example, William Sydow, Director, Nebraska Oil and Gas Conservation Commission, stated at the EPA's Public Meeting on August 24, 2000, that hydraulic fracturing is not experimental, and has been used since the late1940s. He said that fracturing fluids include a little bit of guargum, maybe some nitrogen or carbon dioxide and water and sand, and that it all comes up. The attached August 24, 2000 press release of the Interstate Oil and Gas Compact Commission even characterizes the fracturing fluids as a "fluid similar to the toy slime children play with." The hazardous materials in gelling agents that were identified in the attached Bureau of Land Management documents include: benzine, ethylbenzine, methyl tert-butyl ether, napthalene, PAHs, POM, sodium hydroxide, toluene, m-Xylene, 0-xylene, and p-xylene. The hazardous substances in gelling agents and other fracing materials are not child's play, they are deadly serious. We are now alarmed that the EPA's efforts to study hydraulic fracturing are being trivialized and even mocked.

We have been concerned for some time that our requests to industry and government agencies for full disclosure and analyses of hydraulic fracturing have gone unanswered. The lack of public information on the specifics of fracturing is particularly disturbing given that hydraulic fracturing has been carried out as part of the federal oil and gas program. However, we are not aware of any National Environmental Policy Act (NEPA) documentation for the Bureau of Land Management's coalbed methane program on federal and Indian lands that has disclosed to decisionmakers or the public the impacts and risks associated with hydraulic fracturing coal seams. The Bureau of Land Management has released the attached lists of the hazardous materials present in fracturing fluids in two non-coalbed methane Environmental Impact Statements. However, these simple listings do not go nearly far enough in informing the public and government agencies as to the direct and cumulative impacts of hydraulic fracturing. The lack of complete NEPA analysis and disclosure of widely used processes such as hydraulic fracturing is a significant part of a pending lawsuit filed by San Juan Citizens Alliance and Southern Ute Grassroots Organization.

As Gwen Lachelt stated in our oral comments at the EPA meeting August 24, we believe the EPA needs to go beyond the proposed methods for gathering information on incidents. Advertisements in local newspapers and informal public meetings in coalbed methane development areas will better inform EPA of the extent of hydraulic fracturing and its impacts. We also caution the EPA to not rely too heavily on complaints filed with state oil and gas commissions and oil and gas companies. We receive phone calls on an ongoing basis from affected residents who state that they do not bother to contact the responsible regulatory agencies or companies because their complaints often go unanswered. Also, oil and gas commissions are often dominated by oil and gas industry representatives, further diminishing residents' trust of agencies charged with regulating the oil and gas industry.

We are pleased the EPA is launching this study. The following questions are based on the experiences of people in southwestern Colorado, our discussions with people from other oil and gas producing regions, and our own preliminary research that has revealed very little publicly available documentation of potentially serious adverse environmental and health impacts associated with hydraulic fracturing.

Purpose/Need

Is fracturing a necessary completion technique or does it merely create larger fractures that increase the rate of gas recovery and thus profits?

Does fracturing disrupt the natural fracture pattern resulting in the need for more gas wells?

Geophysical Impacts

Since hydraulic fracturing shakes houses and disrupts normal water well production, how does the fracturing affect other geological formations outside of the target formation?

Can intentionally created fractures extend outside of the targeted formation?

What level of control does an operator have over the migration of a hydraulically-created fracture?

Does the energy released during a hydraulic fracture operation threaten the structural integrity other formations, especially shallower aquifers used for drinking water?

Can hydraulic fracturing aggravate migration of methane into drinking water supplies by enhancing the natural fracture systems that link the coalbeds to the surface?

Chemical Composition

What types of chemicals, common and experimental, have been used in hydraulic fracturing?

What types of chemicals, common and experimental, have been used in acid fracturing?

What other types of fracturing techniques are available?

What are the range of quantities used for each type of chemical?

Do less damaging alternatives exist?

Human Health/Environmental Impacts

What are the recovery rates of injected fracturing materials?

What is the range of quantities of fluid loss during fracturing?

What are the environmental and human health effects of fracturing materials?

What are the effects of hydraulic fracturing on organisms found in coalseams?

What are the bioaccumulation effects of remaining fracturing fluids in subsurface ecosystems?

What are the synergistic effects of fracturing materials with other materials (natural and introduced) associated with coalbed methane development?

What are the rates and consequences of the biodegradation of remaining fracturing materials?

Where do fracturing wastes go after the wellbore is "cleaned?"

What waste by-products does fracturing create?

What technologies are available to reduce and eliminate fracturing leakoff into natural fissures?

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How do wormholes contribute to loss of fluid into thief zones and natural fissures during fracturing operations?

What ecotoxicology reports have been produced on fracturing?

Thank you again for the opportunity to submit comments on the design of the EPA's hydraulic fracturing study. We look forward to a comprehensive study of the environmental effects of this practice.

Sincerely,

Travis Stills and Gwen Lachelt
Citizens Oil & Gas Support Center

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Comment U

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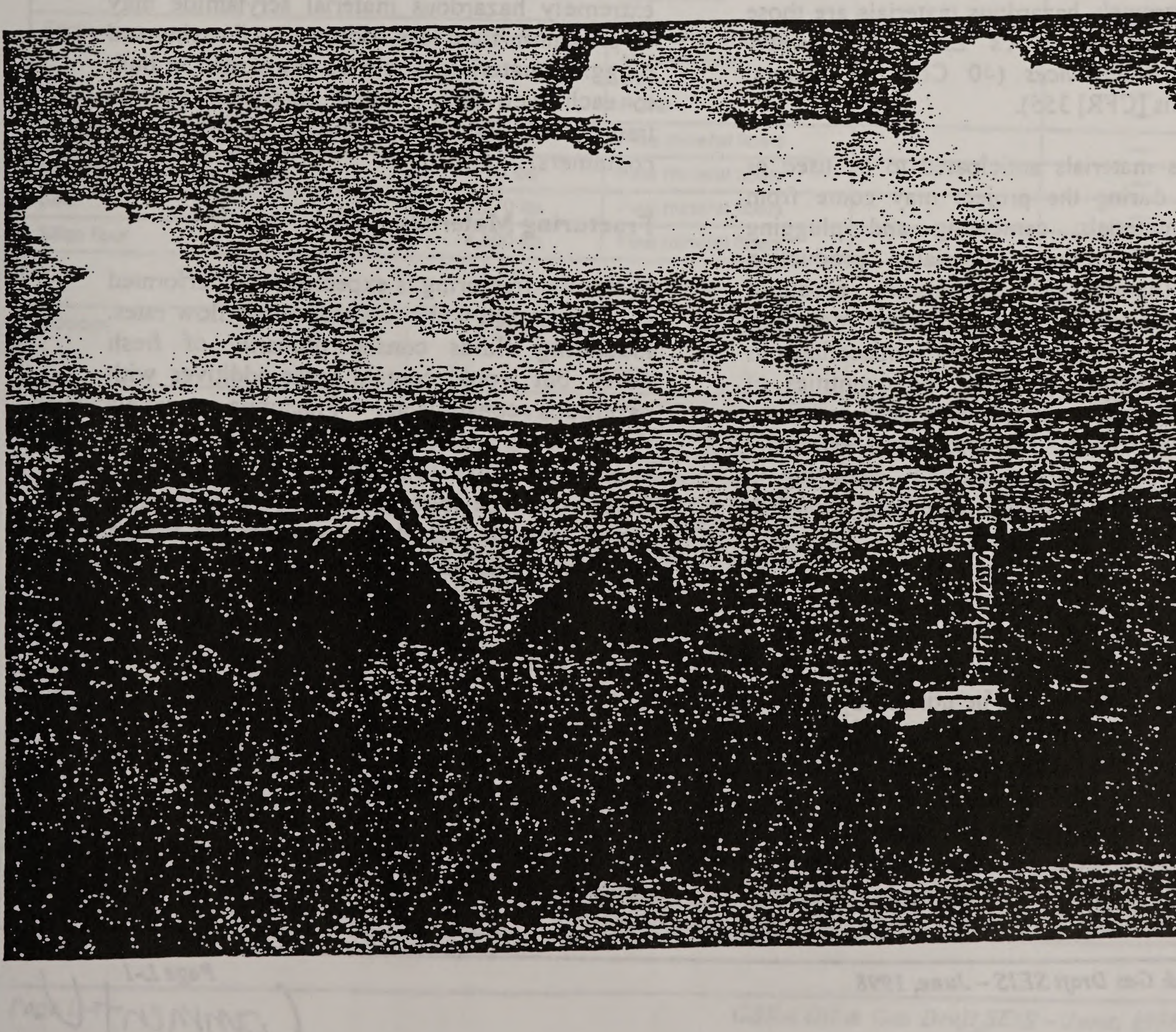
Bureau of Land Management
Colorado State Office

Glenwood Springs Resource Area

Oil & Gas Leasing & Development

Draft Supplemental Environmental Impact Statement

June, 1998



This Hazardous Materials Summary is provided pursuant to Bureau of Land Management (BLM) Instruction Memoranda Numbers WO-93-344 and CO-97-023, which require that all National Environmental Policy Act (NEPA) documents list and describe any hazardous and/or extremely hazardous materials that would be produced, used, stored, transported, or disposed of as a result of a proposed project. This summary serves as a supplement to the Glenwood Springs Resource Area Oil & Gas Environmental Impact Statement.

Materials are considered hazardous if they contain chemicals or substances listed in the Environmental Protection Agency's (EPA's) *Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986*. Extremely hazardous materials are those identified in the EPA's *List of Extremely Hazardous Substances* (40 Code of Federal Regulations [CFR] 355).

Hazardous materials anticipated to be used or produced during the project may come from drilling materials: cementing and plugging materials: fracturing materials: production products (natural gas. condensates. produced water): fuels and lubricants: pipeline materials: combustion emissions: and miscellaneous materials. Where possible. the quantities of these products or materials have been estimated on a per-well basis. Hazardous and extremely hazardous constituents potentially occurring in these products or materials have been identified and are listed in Table L-1.

Drilling Materials

Water-based drilling fluids consisting of clays and other additives would be utilized by drilling companies for drilling each well. The polyacrylamides used in drilling may contain the extremely hazardous substance acrylamide. Drilling fluid additives would be transported to well locations during drilling operations in appropriate sacks and containers. Drilling fluids, cuttings, and water would be stored in reserve pits located on-site, and reserve pits would be lined as directed by the BLM to conserve water and protect near-surface aquifers. When the reserve pit is no longer required, its contents would be evaporated or solidified in place and the pit backfilled as approved by the BLM.

Cementing and Plugging Materials

Well completion and abandonment operations include cementing and plugging various segments of the well bore to protect freshwater aquifers and other down-hole resources. Wells would be cased and cemented as approved by the BLM (for federal minerals), and Colorado Oil and Gas Conservation Commission (COGCC) (for state and patented minerals). The extremely hazardous material acrylamide may be present in fluid loss additives. All casing and plugging materials would be transported in bulk to each well site. Small quantities may be transported and stored on-site in appropriate containers.

Fracturing Materials

Hydraulic fracturing is expected to be performed at all proposed wells to enhance gas flow rates. Fracturing fluids consist primarily of fresh water, but would contain some additives with hazardous constituents. Fracturing materials would be transported to well locations in bulk or in manufacturer's containers. Waste fracturing fluids would be collected in above-ground tanks and/or reserve pits and evaporated, or hauled away from the location and reused at another well or disposed of at an authorized facility.

Production Products

The purpose of the proposed project is to extract natural gas and oil. Water would also be produced as a by-product.

The primary product of the wells would be natural gas, primarily containing methane and

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APPENDIX L: HAZARDOUS MATERIALS SUMMARY

Source	Approximate Quantities Used or Produced per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Cementing and Plugging Materials				
Anti-foamer	100 lbs	Glycol ethers		—
Calcium chloride flake	2,500 lbs	Fine mineral fibers		—
Cellophane flake	300 lbs	Fine mineral fibers		—
Cements	77,000 lbs	Aluminum oxide Fine mineral fibers		1344-2-1 —
Chemical wash	850 gals	Ammonium hydroxide Glycol ethers		1336-21-6 —
Diatomaceous earth	1,000 lbs	Fine mineral fibers		—
Extenders	17,500 lbs	Aluminum oxide Fine mineral fibers		1344-28-1 —
Fluid loss additive	900 lbs	 Fine mineral fibers Napthalene	Acrylamide	79-06-1 — 91-20-3
Friction reducer	160 lbs	Fine mineral fibers Napathalene PAHs POM		— 91-20-3 — —
Mud flash	250 lbs	Fine mineral fibers		—
Retarder	100 lbs	Fine mineral fibers		—
Salt	2,570 lbs	Fine mineral fibers		—
Silica flour	4,800 lbs	Fine mineral fibers		—
Fracturing Materials				
Biocides	6 gals	Fine mineral fibers PAHs POM		— — —
Breakers	145 lbs	Ammonium persulphate Ammonium sulphate Copper compounds Ethylene glycol Fine mineral fibers Glycol ethers		7727-54-0 7783-20-2 — 107-21-1 — —
Clay stabilizer	50 gals	Fine mineral fibers Glycol ethers Isopropyl alcohol Methanol PAHs POM		— — 67-63-0 67-56-1 — —
Crosslinkers	60 gals	Ammonium chloride Methanol Potassium hydroxide Zirconium nitrate Zirconium sulfate		12125-02-9 67-56-1 1310-58-3 13746-89-9 14644-61-2
Foaming agent	120 gals	Glycol ethers		—
Gelling agent	950 gals	Benzene Ethylbenzene Methyl tert-butyl ether		71-43-2 100-41-4 1634-04-4

Comment U

APPENDIX L: HAZARDOUS MATERIALS SUMMARY

Source	Approximate Quantities Used or Produced per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
		Napthalene		91-20-3
		PAHs		—
		POM		—
		Sodium Hydroxide		1310-73-2
		Toluene		108-88-3
		m-Xylene		108-38-2
		o-Xylene		95-47-6
		p-Xylene		106-42-3
pH buffers	60 gals	Acetic acid		64-19-7
		Benzoid acid		65-85-0
		Fumaric acid		110-17-8
		Hydrochloric acid		7647-01-0
		Sodium hydroxide		1310-73-2
Sands	2.000.000 lbs	Fine mineral fibers		—
Solvents	50 gals	Glycol ethers		—
Surfactants	15 gals	Glycol ethers		—
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		PAHs		—
		POM		—
		Production Products		
Liquid hydrocarbons	<5-45 bpd	Benzene		71-43-2
		Ethyl benzene		100-41-4
		n-Hexane		110-54-3
		PAHs		—
		POM		—
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Natural gas	0.5>5.0 mmcfd	n-Hexane		110-54-3
		PAHs		—
		POM		—
Produced water/cuttings	0.5-10 bpd water and an unknown quantity of cuttings	Arsenic		7440-38-2
		Barium		7440-39-3
		Cadmium		7440-43-9
		Chromium		7440-47-3
		Lead		7439-92-1
		Manganese		7439-96-5
		Mercury		7439-97-6
		Radium 226		—
		Selenium		7782-49-2
		Uranium		—
		Other radionuclides		—

U.S. Department of the Interior
Bureau of Land Management
Wyoming State Office

Rawlins Field Office August 2000

RECORD OF DECISION
Environmental Impact Statement
South Baggs Area
Natural Gas Development Project
Carbon County, Wyoming

All known hazardous materials present in the proposed drilling fluids and additives are listed in Table C-4. These materials are: sodium hydroxide (CAS 1310-73-2), present in caustic soda; acrylamide (CAS 79-06-1), present in Uni-Drill (partially hydrolyzed polyacrylamide); barium compounds, present in UNIBAR (barium sulfate); and fine mineral fibers, present in lime, mica, and Uni-Gel (sodium montmorillonite or barite). No hazardous materials are known to occur in sawdust or paper, and no extremely hazardous materials are known to be present in any of the drilling fluids and additives.

Drilling fluid additives will be transported to well locations during drilling operations in appropriate sacks and containers in compliance with DOT regulations. Drilling fluids, cuttings, and water will be stored in reserve pits, and pits will be fenced to protect wildlife from exposure. Netting (1 inch mesh), to protect waterfowl and other birds, and pit liners, to protect shallow groundwater aquifers, will be used on all reserve pits as deemed appropriate by the BLM.

When the reserve pit is no longer required, its contents will be evaporated or solidified in place, and the pit backfilled, as approved by the BLM. All reserve pit solidification procedures using flyash or other BLM-approved materials will be approved by the WOGCC and/or WDEQ prior to implementation. If necessary under special, unanticipated circumstances, reserve pit contents will be removed and disposed of at an appropriate facility in a manner commensurate with all relevant state and federal regulations.

2.2.5 Fracturing Fluids

Hydraulic fracturing is expected to be performed at some South Baggs wells to augment gas flow rates. Approximately 78,700 gallons of fracturing fluids, consisting primarily of fresh water, will be required per well for the proposed project. Fracturing fluid additives and their approximate volumes include: LGV-VI with diesel fuel (953 gal/well), GES-STA (150 lbs/well), OPTI-FLO III (144 lbs/well), CLAYFIX II (157 lbs/well), SSO-21 (15 gal/well), CL-29 (59 gal/well), BA-20 (38 gal/well), SP BREAKER (27 lbs/well), GBW-30 (9 lbs/well), BE-5 microbiocide (36 lbs/well), and sand (299,400 lbs/well) (Table C-2).

The hazardous materials present in fracturing fluid components are listed in Table C-2 and include: benzene, toluene, ethylbenzene, p-xylene, m-xylene, o-xylene, methyl tert-butyl ether, naphthalene, polynuclear aromatic hydrocarbons, and polycyclic organic matter contained in LGC-VI with diesel fuel (hydrocarbon gel concentrate);glycol ether present in OPTI-FLO III and SSO-21; methanol (CAS 67-56-1) present in SSO-21; formic acid (CAS 64-18-6), ammonium chloride (CAS 12125-02-9), zirconium nitrate (CAS 13746-89-9), and zirconium sulfate (CAS 14644-61-2) present in CL-29; acetic acid (CAS 64-19-7) present in BA-20; and fine mineral fibers present in sand. No hazardous materials are known to be present in GEL-STA (sodium salt), CLAYFIX II (alkylated quaternary chloride), SP BREAKER (sodium persulfate), GBW-30 (cellulase enzyme carbohydrate), and BE-5 (5-chloro-2-methyl-4-isothiazolin-3-one, 2-methyl-4-isothiazolin-3-one, a microbiocide). No extremely hazardous materials are known to be present in any of the fracturing fluid additives.

Fracturing fluids and additives will be transported to well locations in bulk (e.g., LGC-VI with diesel fuel, sand) or in appropriately designed and labeled containers (e.g., OPTI-FLO III in 50 lb fiber drums; SSO-21, CL-29, and BA-20 in 55 gal drums). All transportation of fracturing fluids

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and additives will be in adherence with DOT rules and regulations.

During fracturing, fluids are pumped under pressure down the well bore and out through perforations in the casing into the formation. The pressurized fluid enters the formation and induces hydraulic fractures. When the pressure is released at the surface, a portion of the fracturing fluids will be forced to the well bore and up into a tank. The fracturing fluids will then be transferred to lined reserve pits and evaporated, or hauled away from the location and reused or disposed of at an authorized facility. Decisions regarding the appropriate disposal of fracturing fluids will be made by the BLM on a case-by-case basis.

2.2.6 Cement and Additives

Well completion and abandonment operations will entail cementing and plugging various segments of the well bore to protect freshwater aquifers and other down-hole resources. Materials potentially used for cementing operations include: cement, calcium hydroxide, calcium chloride, pozzlans, sodium bicarbonate, potassium chloride, and insulating oil. An unknown quantity of cement and additives, which may contain the hazardous material classes of fine mineral fibers, polycyclic organic matter, and polynuclear aromatic hydrocarbons, will be transported in bulk to each well site by a qualified cement supply company. Small quantities may be transported and stored on-site in 50 pound sacks. Wells will be cased and cemented as directed and approved by the BLM (for federal minerals) and WOGCC (for state and patented minerals). No extremely hazardous materials are known to be present in the cement and additives proposed for use by this project.

2.2.7 Miscellaneous Materials

Miscellaneous materials, potentially containing hazardous and/or extremely hazardous materials, that may be used for the proposed project include: methanol and corrosion inhibitors. The material will be transported to the site by qualified service and supply companies and will be used and disposed of following manufacturer's guidelines.

An unknown quantity of methanol will be used to de-ice well bores ad as a hydrate preventer during completion and natural gas transport operations. Methanol is a listed hazardous chemical and will be stored, transported, used, and disposed of in adherence with all applicable federal and state rules, regulations, and guidelines.

2.3 COMBUSTION EMISSIONS

Combustion emissions from gasoline and diesel engines, as well as flaring natural gas, will occur as a result of this project. The complete oxidation of hydrocarbon fuels yields only carbon dioxide and water as combustion products; however, complete combustion is seldom achieved. Unburned hydrocarbons, particulate matter (e.g., carbon, metallic ash), carbon monoxide, nitrogen oxides, and possibly sulfur oxides will be expected as direct exhaust contaminants. Secondary contaminants will likely include the formation of ozone from the photolysis of nitrogen oxides. A listing of the hazardous and extremely hazardous materials potentially present in combustion emissions is provided in Table C-3.

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Table A-9. Generic List of Hazardous Chemical Categories for the Oil and Gas Exploration and Production Industry.

Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Acetylene Gas (CAS#74-86-2)	Fire, sudden release of pressure
Acids Hydrochloric Acid (<30%)(CAS#7647-01-0) Hydrofluoric acid (<12%)(CAS#7664-39-3) Sulfuric acid (CAS#7664-93-9)	Immediate (Acute)
Alkalinity and pH Control Materials Calcium hydroxide (CAS#1305-62-0) Potassium hydroxide (CAS#1310-58-3) Soda ash (CAS#497-19-8) Sodium bicarbonate (CAS#144-55-8) Sodium carbonate (CAS#497-19-8) Sodium hydroxide (CAS#1310-73-2)	Immediate (Acute)
Biocides Amines Glutaraldehyde (CAS#111-30-8) Isoporpanol (CAS#67-63-0) Thiozolin	Immediate (Acute), Fire
Breakers Ammonium persulfate (CAS#7727-54-0) Benzoic acid (CAS#65-85-0) Enzyme Sodium acetate (CAS#127-09-3) Sodium persulfate (CAS#7772-27-1)	Immediate (Acute), Fire
Buffers Sodium acetate (CAS#127-09-3) Sodium bicarbonate (CAS#144-55-8) Sodium carbonate (CAS#497-119-8) Sodium deacetate	Immediate (Acute)
Calcium Compounds Calcium bromide (CAS#71626-99-8) Calcium hypochlorite (CAS#7778-54-3) Calcium oxide (CAS#1305-78-8) Gypsum (CAS#10101-41-4) Lime (CAS#1305-78-8)	Immediate (Acute)
Cement (CAS#65997-15-1)	Immediate (Acute)

APPENDIX A

Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Cemment Additives - Accelerators Calcium chloride (CAS#10035-04-8) Gypsum (CAS#10101-41-4) Potassium chloride Sodium chloride (CAS#7647-14-5) Sodium metasilicate	Immediate (Acute)
Cement Additives - Fluid Loss Cellulose polymer Latex	Immediate (Acute)
Cement Additives - Miscellaneous Cellulose flakes (CAS#9004-34-6) Coated aluminum Gilsonite (CAS#12002-43-6) Lime (CAS#1305-78-8) Long chain alcohols	Immediate (Acute)
Cement Additives - Retarders Cellulose polymer Lignosulfonates	Immediate (Acute)
Cement Additves - Weight Modification Barite (CAS#7727-43-7) Bentonite Diatomatious earth (CAS#68855-54-9) Fly ash Glass beads Hematite (CAS#1317-60-8) Ilmenite Pozzolans	Immediate (Acute)
Chloride Salts Calcium chloride Potassium chloride Sodium chloride (CAS#7647-14-5) Zinc chloride (CAS#7646-85-7)	Immediate (Acute)
Chlorine Gas (CAS#7782-50-5)	Immediate (Acute), Sudden release of pressure

Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Corrosion Inhibitors 4-4' Methylene dianiline (CAS#101-77-9) Acetylenic alcohols Amine Formulations Ammonium bisulfite (CAS#10192-30-0) Basic zinc carbonate (CAS#3486-35-9) Gelatin Ironite sponge (CAS#1309-37-1) Sodium chromate (CAS#7775-11-3) Sodium dichromate (CAS#10588-01-9) Sodium polyacrylate Zinc lignosulfonate Zinc oxide (CAS#1314-13-2)	Immediate (Acute), Delayed (chronic), Fire
Crosslinkers Boron Compounds Organo-metallic complexes	Immediate (Acute), Fire
Defoaming Agents Aluminum stearate Fatty acid salt formation Mixed alcohols Silicones	Immediate (Acute)
Deflocculants Acrylic polymer Calcium lignosulfonate Chrome-free lignosulfonate Chromium lignosulfonate Iron lignosulfonate Quebracho Sodium acid pyrophosphate (SAPP) Sodium hexametaphosphate (CAS#10124-56-8) Sodium phosphate (oilfos) Sodium tetraphosphate Stryene, maleaic anhydride co-polymer salt Sulfo-methylated tannin	Immediate (Acute)
Detergents/Foamers Amphoteric surfactant formulation Ethoxylated phenol Detergents	Immediate (Acute), Fire
Explosives Charged well jet perforating gun, Class C explosives Detonators, Class A explosives Explosive power device, Class B	Sudden release of pressure

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APPENDIX A

Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Filtration Control Agents Acrylamide AMPS copolymer Aniline formaldehyde copolymer hydrochlorite Causticized leonardite Sulfomethylated phenol formaldehyde Leonardite Partially hydrolyzed polyacrylamide Polyalkanolamine ester Polyamine acrylate Polyanionic cellulose Potassium lignite Preserved starch Sodium carboxymethyl cellulose (CAS#9004-32-4) Starch (CAS#9005-25-8) Vinylsulfonate copolymer	Immediate (Acute)
Flocculants Anionic polyacrylamide	Immediate (Acute)
Fluoride Generating Compounds Ammonium bifluoride (CAS#1341-49-7) Ammonium fluoride (CAS#12125-0108)	Immediate (Acute)
Friction Reducers Acrylamide methacrylate copolymers Sulfonates	Immediate (Acute)
Fuels Diesel (CAS#68476-34-6) Fuel oil Gasoline (CAS#8006-61-9)	Immediate (Acute), Delayed (Chronic), Fire
Gelling Agents Cellulose and guar derivatives	Immediate (Acute)
Gel Stabilizers Sulfites Thiosulfates	Immediate (Acute)
Hydrogen Sulfide (CAS#7783-06-4)	Immediate (Acute), Fire
Inert Gases Carbon Dioxide (CAS#124-38-9) Nitrogen (CAS#7727-37-9)	Immediate (Acute), Sudden release of pressure

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Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Lost Circulation Materials Cane fibers Cedar fibers Cellophane fibers Corn cob Cottonseed hulls Mica (CAS#12001-26-2) Nut shells Paper Rock wool Sawdust	Immediate (Acute)
Lubricants, Drilling Mud Additives Graphite (CAS#7782-42-5) Mineral oil formulations Organo-fatty acid salt Vegetable oil formulations Walnut Shells	Immediate (Acute)
Lubricants, Engine Motor oil Grease	Immediate (Acute)
Miscellaneous Drilling Additives Diatomaceous Earth (CAS#68855-54-9) Oxalic acid (CAS#144-62-7) Potassium acetate (CAS#127-08-2) Zinc bromide (CAS#7699-45-8)	Immediate (Acute), Delayed (Chronic)
Odorants Mercaptans, aliphatic	Immediate (Acute)
Oil Based Mud Additives Amid polymer formulations Amine treated lignite Asphalt Diesel (CAS#68476-34-6) Gilsonite (CAS#12002-43-6) Mineral oil Organophilic clay Organophilic hectorite Petroleum distillate (CAS#8030-30-6) Polymerized organic acides Sulfonate surfactant	Immediate (Acute), Delayed (Chronic), Fire

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Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Organic Acids Acetic acid (CAS#64-19-7) Acetic anhydride (CAS#108-24-7) Benzoic acid (CAS#65-85-0) Citric acid (CAS#5949-29-1) Formic acid (CAS#64-18-6) Organic acid salts	Immediate (Acute), Fire
Preservatives Dithiocarbamates Paraformaldehyde (CAS#30525-89-4) Isothiazions	Immediate (Acute)
Produced Hydrocarbons Condensate Crude oil (CAS#8002-05-9) Natural Gas	Immediate (Acute), Delayed (Chronic), Fire, Sudden release of pressure
Proppants Bauxite (CAS#1318-16-7) Resin coated sand Zirconium proppant	Immediate (Acute)
Radioactive, Special Form Cesium 137 (encapsulated) logging tool	Delayed (Chronic)
Resin and Resin Solutions Melamine resins Phenolic resins Polyglycol resins	Immediate (Acute), Fire
Salt Solutions Aluminum chloride (CAS#7446-70-0) Ammonium chloride (CAS#12125-02-9) Calcium bromide (CAS#17626-99-8) Calcium chloride (CAS#10035-04-8) Calcium sulfate (CAS#778-18-9) Ferrous sulfate (CAS#7782-63-0) Potassium chloride(CAS#7447-40-7) Sodium chloride (CAS#7647-14-5) Sodium sulfate (CAS#7757-82-6) Zinc bromide (CAS#7699-45-8) Zinc chloride (CAS#7646-85-7) Zinc sulfate	Immediate (Acute)

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Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Scale Inhibitors Ethylenediaminetetraacetic acid (EDTA) (CAS#60-00-4) Inorganic phosphates Isopropanol (CAS#67-63-0) Nitrilotriacetic acid (NTA) (CAS#139-13-9) Organic phosphates Polyacrylate Polyphosphates	Immediate (Acute), Fire
Shale Control Additives Hydrolyzed polyacrylamide polymer Organo-aluminum complex Polyacrylate polymer Sulfonated asphaltic residuum	Immediate (Acute)
Silica	Immediate (Acute), Delayed (Chronic)
Solvents 1,1,1-Trichloreoethane (CAS#71-55-6) Acetone (CAS#67-64-1) Aliphatic hydrocarbons Aromatic naphtha (CAS#8032-32-4) Carbon tetrachloride (CAS#56-23-5) Diacetone alcohol Ethylene glycol monobutyl ether (CAS#111-76-2) Kerosene (CAS#8008-20-6) Isopropanol (CAS#67-63-0) Methyl ethyl ketone (MEK) (CAS#78-93-3) Methyl isobutyl ketone (MIBK) (CAS#108-10-1) Methanol (CAS#67-56-1) t-Butyl alcolhol (CAS#75-65-0) Toluene (CAS#108-88-3) Turpentine (CAS#8006-64-2) Xylene (CAS#1330-20-7)	Immediate (Acute), Delayed (Chronic), Fire
Spotting Fluids Nonoil base spotting fluid Oil base spotting fluid (diesel oil base) Oil base spotting fluid (mineral oil base) Sulfonated vegetable ester	Immediate (Acute), Fire
Surfactants - Corrosive Alcohol ether sulfates Amines Quarternary polyamine Sulfonic acids	Immediate (Acute)

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Hazardous Chemical Category (With Examples of Representative Chemicals)	Physical and Health Hazards
Surfactants - Flamable Amines Ammonium salts Fatty alcohols Isopropanol (CAS#67-56-1) Oxylalkylated phenols Petroleum naphtha (CAS#8030-30-6) Sulfonates	Immediate (Acute), Fire
Surfactants - Miscellaneous Amine salts Glycols Phophonates	Immediate (Acute)
Temporary Blocking Agents Benzoic acid (CAS#65-85-0) Naphthalene (CAS#91-20-3) Petroleum wax polymers Sodium chloride (CAS#7647-14-5)	Immediate (Acute)
Viscosifiers Attapulgite Bentonite Guar gum (CAS#9000-30-0) Sepiolite Xantham gum	Immediate (Acute)
Weight Materials Barite (CAS#7727-43-7) Calcium carbonate (CAS#1317-65-3) Galena Hematite (CAS#1317-60-8) Siderite	Immediate (Acute)

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ATTACHMENT #3
SJCA/OGAP Joint Comments
SUIT DEIS

United States Department of the Int

BUREAU OF LAND MANAGEMENT
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7076

IN REPLY REFER TO:

In Reply Refer To:
1278 (CO-954)
FOIA 98-35

OCT 6 1998

San Juan Citizens Alliance
Attn: Jerry Swingle
P.O. Box 2461
Durango, Colorado 81301

Dear Mr. Swingle:

This letter is in response to your Freedom of Information Act (FOIA) request of June 5, 1998, in which you requested copies of BLM documents containing the following information:

1. "All completed studies, assessments, and evaluations, whether conducted by the BLM or other entities, that examine or discuss the well-density requirements for draining the coalbed-methane from the Fruitland formation of the San Juan Basin."

2. "All completed studies, assessments, and evaluations, whether conducted by the BLM or other entities, that examine or discuss the various technologies--experimental and available--for draining the coalbed-methane from the Fruitland formation of the San Juan Basin."

3. "All completed studies, assessments, and evaluations, whether conducted by the BLM or other entities, that examine or discuss the economics of draining the coalbed-methane from the Fruitland formation of the San Juan Basin."

Because of the broad and general nature of the subject of your request, we were unable to identify which records are being sought. By letter, on June 30, 1998, you were requested to be more specific concerning the documents you were requesting. By letter, dated August 14, 1998, you clarified which documents you were seeking. This response will address each item as listed in your reply.

1. "All completed studies, assessments, and evaluations, . . . that examine or discuss the well-density requirements for draining the coalbed-methane from the Fruitland Formation of the San Juan Basin." Enclosed is the "Ignacio Blanco Field Fruitland Formation Coalbed Methane Gas Recovery Estimates for U.S. Exploration Company Leases", dated September 18, 1989; and, Spacing Order 112-85.

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As stated in your letter of August 14, 1998, "If this numbered request is in excess of 300 pages, this numbered request may be fulfilled by providing a list of documents, descriptions of those documents and a full opportunity to review the documents in Durango . . . ." The "Presentation And Exhibits for the San Juan Basin Coalbed Methane Spacing Study", dated February 21, 1991, is more than 300 pages, therefore, the cover page, table of contents, and study overview are enclosed.

2. "All completed studies, assessments, and evaluations, . . . that examine or discuss various technologies . . . for draining the coalbed-methane from the Fruitland Formation of the San Juan Basin." Enclosed are: "Status Report on Coal-Seam Gas Drilling for National Public Land Advisory Council"; "Fracturing techniques depend on coal seam characteristics"; "SPE 20732, enhanced Coalbed Methane Recovery"; and "Report on Implications of Coal-Bed Methane Development on Groundwater in the Northern San Juan Basin, Colorado."

The following documents are more than 300 pages, therefore, the cover pages, tables of contents, and/or summaries and introductions are enclosed: "Environmental Planning Document, Volume 1, San Juan Basin Coal Degas Project, dated March, 1988; "Environmental Planning Document, Volume 2 - Resource Maps, San Juan Basin Coal Degas Project", dated March, 1988; "Coalbed Methane Reservoir Properties", dated August, 1994; "Coal Natural Gas Reservoir Properties and Formation Evaluation Techniques"; and, "Western Cretaceous Coal Seam Project, Annual Report, 1990".

3. "All completed studies, assessments, and evaluations, . . . that examine or discuss the economics of draining the coalbed-methane from the Fruitland Formation of the San Juan Basin." Enclosed is the "Coalbed Methane in the Rocky Mountains, Structuring Transactions to Maximize the Section 29 Tax Credit". Also refer to Item No. 1 above for further information.

4. "BLM Drainage Manual and Handbook." Enclosed is a copy of the "Drainage Standards and Procedures Manual and Handbook".

5. "All correspondence since 1985 between the BLM and the Council on Environmental Quality concerning development of coalbed-methane from the Fruitland Formation of the San Juan Basin." No records exist responsive to this portion of your request.

6. "All Correspondence since 1985 between the BLM and the Environmental Protection Agency concerning development of coalbed-methane from the Fruitland Formation of the San Juan Basin". Enclosed is a comment letter from EPA to William T. Sexton, Forest Supervisor, dated April 22, 1991.

7. "All correspondence since 1985 between the BLM and the Advisory Council on Historic Preservation, State Historic Preservation Officer, or other agencies responsible for historic preservation concerning development of coalbed-methane from the Fruitland Formation of the San Juan Basin." No records exist responsive to this portion of your request.

Comment V

8. "All correspondence between the BLM and the Fish and Wildlife Service concerning development of coalbed-methane from the Fruitland Formation of the San Juan Basin". Enclosed is a Memorandum from the USFWS to BLM "Comments on the Colorado Oil and Gas Leasing Draft EIS", dated August 21, 1990.

9. "All notices, approvals or applications . . . related to proposed or approved development by any and all developers of coalbed-methane from the Fruitland Formation of the San Juan Basin at well densities less than 320 acres per well." Enclosed is a letter from AMOCO to Mr. Bob Moore, State Director, dated November 22, 1994; Instruction Memorandum No. 98-, from the Director to State Directors "Policy Guidance on Coalbed Methane Gas Production"; letter dated November 24, 1997 from Calvin J. Joyner to Mr. Richard Griebling; letter, dated November 19, 1997 from Jim Lovato to Mr. Richard Griebling; Memorandum from State Director to Director "Request for Guidance on Ownership of Coalbed Methane Production from Federal Coal"; "COGCC Spacing Order No. 112-138; Huber Proposed Development Map; letter from Calvin J. Joyner to La Plata County Landowners; and, letter, dated June 15, 1998, from J. Scott Zimmerman, J.M. Huber Corporation to Mr. Jim Lovato.

10. "Any and all documents and documentation of communications . . . addressing the issue of downspacing or modification of existing spacing of oil and gas wells on a basin-wide level, or any level greater than individual developer requests for downspacing approval, permission to increase density through utilization of option wells, or other individualized, site-specific spacing modifications." Enclosed are: "Southern Ute Indian Tribe, BLM, and BIA Announce Public Scoping Meetings"; Memorandum of Understanding between Southern Ute Indian Tribe, BIA, and BLM; and, "Status and Options for Preparing an EIS on the Southern Ute Indian Reservation."

11. "All correspondence between the BLM and the Colorado Oil and Gas Conservation Commission . . . relevant to consideration, adoption, review or reconsideration of the August 22, 1991 Memorandum of Understanding between the Colorado BLM and COGCC and of predecessor agreements." "This requests covers the time period of 1950 to the present." Enclosed are: Memorandum of Understanding between The Colorado BLM and the Colorado Oil and Gas Conservation Commission, dated August 22, 1991; Memorandum of Understanding between Southern Ute Indian Tribe and BLM, And, Interagency Agreement between Bureau of Indian Affairs and BLM, dated August 22, 1991; Instruction Memorandum No. NM-93-092, dated February 8, 1993, Spacing of Indian Lands; and, Memorandum, dated February 24, 1993, Spacing of Indian Lands.

12. "Any and all notes, minutes or other documentation produced as a result of all semiannual coordination meetings held pursuant to paragraph F.2. of the 'Colorado BLM/COGCC MOU'."

Initially coordination between agencies was done through the San Juan Basin Oil and Gas Coordinating Committee (SJOGCC), aka the Campbell Committee. The committee was later transformed into what is now called the GORT committee (Gas Oil Regulatory Team).

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Enclosed are meeting minutes dated December 13, 1990, September 6, 1990, May 31, 1990, March 4, 1990, April 5, 1990, October 5, 1989, August 31, 1989, July 27, 1989, and, November 1, 1989. Also enclosed is a Memorandum, dated July 07, 1986, Distribution of State Cause Orders.

13. "Any and all notices provided by COGCC to the Deputy State Director, Mineral Resources, Colorado BLM, or any other BLM employee, regarding requests for hearings . . . as required under paragraph F.3 of the "Colorado BLM/COGCC MOU'". No records exist for this portion of your request.

14. "Any and all studies, reports, analyses, or other documentation regarding the drainage of federally owned oil, gas or coalbed-methane deposits that are located adjacent to non-federally owned oil, gas or coalbed-methane deposits, where the drainage of federal resources may result from extraction of such non-federal minerals via wells placed on federal or non-federal surface lands". No records exist for this portion of your request.

15. "Documentation of agency policy or procedure discussing the timing and means for initiating 'drainage determinations' where the is a potential for drainage of federal oil, gas or coalbed-methane as a result of adjacent non-federal oil, gas or coalbed-methane extraction, and for implementing protective measures where such drainage is found." Enclosed is Instruction Memorandum No. 96-180, dated September 5, 1996, Bureauwide Interim Guidance Replacing the Oil and Gas Manual 3160-2 Drainage Protection after August 23, 1996.

16. "Any and all documents and documentation of communications . . . related to the agency's determination of whether or not a Supplemental Environmental Impact Statement or other analysis . . . be prepared in response to applications for downspacing, infill drilling, option wells or other type of application, inquiry or request by any person for extraction of the coalbed-methane from the Fruitland Formation at increased well densities. No records exist for this portion of your request.

17. "All materials . . . used by BLM employees . . . to evaluate the Colorado Oil and Gas Conservation Commission spacing decisions in the Long Hollow area". No records exist for this portion of your request.

18. "All materials, in addition to any which may already be provided under a prior numbered request in this letter, used by BLM employees, including but not limited to Jim Lovato, Kent Hoffman, and Dan Rabinowitz, to analyze Applications to Drill during 1998". Enclosed are worksheets used by the San Juan Resource Area when reviewing and Application for Permit to Drill (APD).

If you wish to appeal this partial "no records" denial, your written appeal must be received within 20 working days (Saturdays, Sundays, and public holidays exempted) of the date of this denial. Your appeal should be directed to the Freedom of Information Act Officer, Office of the Assistant Secretary, Administration and Management, U.S.

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Department of the Interior, 1849 C Street, NW, MS 5312 MIB, Washington, D.C. 20240. Your appeal must be accompanied by a copy of your original request and this letter. The appeal should be marked, both on the envelope and on the face of the appeal letter, with the legend "FREEDOM OF INFORMATION APPEAL." To expedite the appellant process and to ensure full consideration of your appeal, your letter should contain a brief statement of the reason why you believe this decision is in error.

Should there be any questions on this matter, contact Sherri Thompson on (303) 239-3758, or Patsy Lynch on 303-239-3616.

Sincerely,

Patsy J. Lynch

Patsy J. Lynch
State Records Administrator

Enclosures

Comment U

ATTACHMENT #4
SJCA/OGAP Joint Comments
SUIT DEIS

HALLIBURTON

Fracturing Fluid Systems

The Challenge: Create an economical fluid that easily and safely transports the required proppant into the fracture. The fluid must then break and be recovered from the fracture, allowing the proppant pack to produce unimpeded by the placement fluid.

The Solution: The wide range of Fracturing Fluid Systems available from Halliburton.

Halliburton has long been the industry leader in giving you the most value from the stimulation treatment by increasing hydrocarbon production from your formation. Halliburton considers all of the design requirements necessary for a successful job including:

- Fluid type
- Viscosity requirements
- Fluid rheology
- Economics of fluid
- Experience with local formations
- Laboratory data on the formation
- Material availability
- Proppant selection

In fact, Halliburton tailors the treatment fluid specifically to your reservoir. The result: Minimized damage, maximized results. Whether your application calls for linear gels, crosslinked gels, LGCs, or foam, we have the experience and knowledge to design, prepare, and carry out your stimulation operation.

Quality and Value for Hydraulic Fracturing

Comment U

phase of the fluid system (usually gelled), a foaming agent, and an internal phase of typically 60 to 80% of N_2 or CO_2. Foamed fluids can be applied to virtually all types of oil and gas wells, over a wide range of pressure, where it is important to minimize damage. The low liquid content of foams leaves less liquid to remove from the well. Foams produce very thin filter cake, yet have low fluid loss characteristics. The gel in foams can also be crosslinked for higher viscosity. N_2 is compatible with all crosslinked fluid systems, while CO_2 is compatible with only the Pur-Gel™ III system.

Comparison of Fluid Properties

Fluid Name	Gelling Agent Type	Liquid Gel Concentrate	Crosslink Agent	Temperature Range (°F)	pH Range	% Polymer Residue
Pur-Gel III	WG-18 (CMHPG)	LGC-VI	CL-23 (Zr)	80 - 275	4 - 7	1 - 2
Thermagel	WG-18 (CMHPG)	LGC-VI	CL-24 (Zr)	250 - 400	10-11	1 - 2
Hybor H	WG-11 (HPG)	LGC-V	CL-22 (B) CL-28M (B)	100 - 320	9 - 12	1 - 2
Hybor G	WG-31 (Guar)	LGC-IV	CL-22 (B) CL-28M (B)	100 - 320	9 - 12	6 - 8
BoraGel H	WG-11 (HPG)	LGC-V	CL-31 (B) K-38 (B)	70 - 300	8.5-12	1 - 2
BoraGel G	WG-31 (Guar)	LGC-IV	CL-31 (B) K-38 (B)	70 - 300	8.5-12	6 - 8
FracGel	WG-31 (Guar)	LGC-V	CL-23 (Zr) CL-24 (Zr)	80 - 300	6 - 10	6 - 8
VersaGel HT	WG-11 (HPG)	LGC-VI	CL-18 (Ti)	100 - 300	7 - 9	1 - 2
MY-T-GEL HT	WG-19 (Guar) WG-31 (Guar)	 LGC-IV	CL-18 (Ti)	100 - 275	7 - 9	6 - 8 6 - 8
MY-T-OIL III	MO-65 & MO-67		MO-66	80 - 250	<7	
MY-T-OIL IV	MO-75		MO-76	80 - 200	<7	
N_2 Foam	WG-11 (HPG) WG-17 (HEC) WG-18 (CMHPG) WG-31 (Guar)	LGC-V LGC-VI LGC-IV	Optional	70 - 350	4 - 12	1 - 2 0 1 - 2 6 - 8
CO_2 Foam	WG-11 (HPG) WG-17 (HEC) WG-18 (CMHPG) WG-31 (Guar)	LGC-V LGC-VI LGC-IV	Optional *	70 - 350 **	4 - 5	1 - 2 0 1 - 2 6 - 8
WaterFrac	WG-11 (HPG) WG-17 (HEC) WG-19 (Guar) WG-31 (Guar)	LGC-V LGC-IV	None	70 - 200	4 - 8	1 - 2 0 1 - 2 6 - 8

*CL-23 (Zr) with WG-18 only.
**Maximum 275°F if crosslinked

Pur-Gel, Hybor, BoraGel, LGC, MY-T-GEL, MY-T-OIL, Thermagel, WG-18, VersaGel, FracGel, MO-75, MO-76, LGC, CL-18, CL-22, CL-23, CL-24, and CL-28M are all marks of Halliburton.

Fluid System Data

Halliburton utilizes dynamic fluid loss testing to select the fluid composition for high and low permeabilities. Extensive fluid-loss tests performed on high and low permeability cores indicate that the selection of a proper treatment fluid is the most effective means of controlling fluid loss. Other important factors include the permeability of the rock, the shear rate, and the pressure drop that drives the fluid loss. High viscosity crosslinked fluids are far superior to linear gel systems for reducing fluid loss in high permeability formations. Testing also indicates borate crosslinked gel systems are more efficient than any of the organometallic systems in high permeability formations. Data used to determine the appropriate fluid system includes:

- Friction pressure determination of the various fluid systems
- Fluid rheology at a variety of temperatures
- Conductivity for the various fluid systems
- Compatibility of the fluid with the formation
- Compatibility of the fluid with the components
- Environmental properties of the fluid systems
- Gel break properties and conditions

Fluid System Additives

Halliburton has a complete line of additives for use during fracturing to help optimize the various parameters of the fracturing fluid system. These additives include clay control agents, gel stabilizers, surfactants, foamers, gel breakers, fluid loss additives, friction reducers, scale inhibitors, biocides, and pH control additives. Each of these have special chemicals that can be used to maximize certain characteristics. For example, foaming additives have been designed for different temperature conditions. Clay control additives have been developed for initial contact as well as for longer lasting protection. And, gel breakers have been developed for various temperature applications and for release rate control.

Comment U

Linear Gel Fluids

Simple formulation over a wide range of polymers and fluids

Linear gel fracturing fluids are formulated with a wide array of different polymers in an aqueous base. Polymers that are commonly used to formulate these linear gels include guar, hydroxypropyl guar (HPG), carboxymethyl HPG (CMHPG), and hydroxyethyl cellulose (HEC). These polymers are dry powders that hydrate or swell when mixed with an aqueous solution and form a viscous gel.

Crosslinked Gel Fluids

Borate Crosslinked Gel Fluids

- *Good proppant transport*
- *Stable fluid rheology at temperatures as high as 300°F*
- *Low fluid loss properties*
- *Good cleanup properties*

Borate crosslinked gel fracturing fluids utilize borate ions to crosslink the hydrated polymers and provide increased viscosity. The polymers most often used in these fluids are guar and HPG. The crosslink obtained by using borate is reversible and is triggered by altering the pH of the fluid system. The reversible characteristic of the crosslink in borate fluids helps them clean up more effectively, resulting in good regained permeability and conductivity. Borate crosslinked fluids are especially useful for FracPac℠ treatments in high permeability formations.

Organometallic Crosslinked Fluids

Excellent proppant transport capabilities at temperatures from 60 to 400°F

Organometallic crosslinked fluids are the most popular class of fracturing fluids. Primary fluids that are widely used are zirconate and titanate complexes of guar, HPG, and CMHPG. Organometallic crosslinked fluids are routinely used to transport the proppant for treatments in tight gas sand formations that require extended fracture lengths. The organometallic crosslinked fluid can also be used in fracturing fluids containing carbon dioxide.

- Provides extreme stability at high temperatures
- Offers more predictable rheological and friction pressure properties
- Provides better control of the crosslinking properties of the fluid
- Allows job design in acidic, neutral, and alkaline pH fluid conditions

Gelled Oil Fluids

Compatibility with almost any formation type

The use of a viscous gelled oil system as a fracturing fluid minimizes the possibility of damage in certain formations such as particle migration resulting from water contacting clays. When used with Halliburton's My-T-Oil IV™ system, gelled oil fluids rapidly develop a consistent gel viscosity which eliminates the need to pre-mix the gel. Also, gel viscosity can be controlled while the treatment is being pumped, enhancing job design flexibility. Gelled oil systems were the first type of high viscosity fluids used in hydraulic fracturing and have the major advantage of being compatible with almost any type of rock formation. And, gelled oil is more convenient in cold weather conditions when compared to water-based fluid systems.

Liquid Gel Concentrates

Efficiency, precision, and environmental value

Liquid gel concentrates (LGC™) are concentrated liquid slurries prepared with the polymers. Since the concentrated polymers are in liquid form, the handling and mixing of dry, powdered material at the wellsite is eliminated. LGC technology also provides an efficient, precise method of varying the viscosity of the fracturing fluid during the fracturing treatment. LGC can be added to an already hydrated gel to adjust the viscosity of an existing gel. It can also be added to water and pre-mixed as the fluid is being pumped, so the viscosity can be controlled while the treatment is being pumped. Liquid gel concentrates can be formulated in either a hydrocarbon or aqueous carrier. And, the LGC system adds environmental value with on-the-fly mixing since there is less fluid waste disposal. Environmentally friendly carrier oils are also available when required.

Foamed Fluids

Minimize damage and fluid loss

As oil and gas producing reservoirs become pressure depleted, the use of foamed fracturing fluids provides energized gas for fluid recovery after the fracturing treatment. Foamed fracturing fluids contain the liquid

Comment U

Increase your bottom line with economical, effective stimulation treatments from Halliburton. To find out more about the full line of fracturing fluid systems available from Halliburton, contact your local Halliburton representative—your Solution Connection℠.

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Comment U

ATTACHMENT #5
SJCA/OGAP Joint Comments
SUIT DEIS

STATE OF COLORADO
OIL & GAS
CONSERVATION COMMISSION

DEPART

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TO: COGCC Commissioners

FROM: Rich Griebling Rich

DATE: February 8, 2001

cc: Greg Walcher
Ron Cattany
Bill Daley
Susan Wadhams
Carol Harmon
Paul Lehnertz
Bill Skewes
Bob Poelstra
Sue Griswold
Butch Friend
Allison Pasternak
David Beaujon
Division Directors
OGCC Employees
MEGA Board Representatives
Monthly Report Mailing List

MONTHLY STAFF REPORT

STATISTICS

Our monthly statistics report is attached.

In January 2001, we processed 203 drilling permits (2,436 annual equivalent), the highest monthly level in several years. The December 2000 number was also high at 191 permits processed (2,292 annual equivalent). In comparison, from 1995 to 1999, we processed an average of 1,035 permits per year. Last year the permit processing level increased dramatically from 1,010 permits in 1999 to 1,529 permits in 2000. Recent numbers indicate an even greater increase for the year 2001.

The COGCC has been redirecting staff resources to address the increasing permit processing workload. Some of our inspection and enforcement goals have been cut back in order to keep up with increased permitting and drilling-related inspection workloads.

II. NORTHWEST COLORADO

- Northwest Colorado Oil and Gas Forum

The next meeting of the Forum, previously scheduled for Thursday, February 1, has been postponed to Wednesday, February 21 from 10:00 a.m. until 2:00 p.m. at the Rifle City Hall. The Forum, which consists of representatives from federal, state and local government, the oil and gas industry and all interested citizens, is co-chaired by Brian Macke and Garfield County Commissioner Larry McCown. Agenda items include updates on oil and gas activity in the Northwest Colorado area, an informational presentation about the Barrett Resources seismic study planned for this summer between Rulison and

Comment U

Responses to Comment "U" from Mark Pearson/Gwen Lachelt, San Juan Citizens Alliance/Oil and Gas Accountability Project

U1 The DEIS was published with printed figures in the document. Unfortunately, the BLM underestimated the number of printed copies that would be required to satisfy the public demand. As a result, some reviewers received the DEIS as a printed document with an enclosed compact disc containing the electronic versions of the figures. The BLM did offer to print the figures, if requested, and made every effort to meet the public's needs. The comment period for the DEIS was 75 days.

U2 Please see the response to comment B2. The remediation of known problems does not drive the formulation of Alternatives. Where problems exist, they are addressed on an ongoing basis by the BIA, BLM, SUIT, and other appropriate Federal, state, or local agencies and remediated. The EIS, consistent with its Purpose and Need, analyzes strategic approaches to the tribe's development of its oil and gas resources.

We have revised the FEIS, Section 1.3, to address the need for additional wells. Evidence supporting the need for infill development has been presented to the BLM and the COGCC, including the production curves presented in Figures 2-3, 2-4, and 2-5. The BLM and the COGCC have independently determined that up to four wells per section for each producing formation are needed to recover the oil and gas resources contained in the Ignacio-Blanco Field.

We have revised the mitigation measures to be more definitive. These measures would be applied, as appropriate, at the site-specific level as stipulations when a project is approved.

U3 Differences in pagination between the CD-ROM and the printed version of the DEIS arose because of difficulties encountered when converting the *WordPerfect* electronic files of the DEIS to a PDF format. This conversion did not alter the any of the text, figures, or tables included in the DEIS. Both versions of the document were intended for release.

U4 The public meeting used an "open house" format. The meeting format was designed to provide for one-on-one interaction between agency officials and the public. We have found that this format is the most engaging and least intimidating one for the public. We believe it provides us the best opportunity to discuss and more fully explore the issues with concerned individuals. Please also see Comment Response C1.

U5 The DEIS was published with printed figures in the document. Unfortunately, the BLM underestimated the number of printed copies that would be required to satisfy the public demand resulting in some parties receiving the DEIS as a printed document with an enclosed compact disc containing the electronic versions of the figures. The BLM did offer to print the figures if requested. Please also see Comment Response U1.

The maps were drafted in September 1999, but for the most part the types of information displayed in the maps–particularly physical, jurisdictional, and biological information–does not change so rapidly as to render the maps unreliable.

U6 We have revised Section 1.3 (Purpose and Need), to further clarify the purpose and need for the proposed action and the EIS. Additionally, we have revised Section 1.3 to state clearly that the purpose of additional wells is to extract oil and gas efficiently from the Ignacio-Blanco Field. The merit of individual infill and ECBM projects will be analyzed at the permit stage. Please also see the response to Comment U-2. We're unsure of the driving issue behind the question of "disproportionate benefits." The tribe's desire to manage its resources in a businesslike manner is undertaken to benefit its economic-development interests.

U7 We have revised Section 1.3 (Purpose and Need) to clarify that the EIS informs the public, in addition to the BLM, BIA, and SUIT. The Federal Register Notices, scoping records, public meeting minutes, and the mailing list are examples of the BLM's commitment to disclose the environmental impacts of oil and gas development on the Southern Ute Indian Reservation to all stakeholders in the process. We believe the BLM has meet all the applicable regulatory requirements in fulfilling this commitment.

U8 The BLM, BIA, and SUIT's elected Tribal Council operate on a government-to-government basis. The Tribal Council is legally charged with policymaking on behalf of the tribe. By example, the proposed action represents the tribe's goal to pursue economic development of its CBM gas resources. The Federal agencies take this direction from the representative tribal body, the Tribal Council, which is elected and governs according to the tribal constitution, and which is clearly and legally responsible for directing the development of tribal mineral resources.

We can only assume that the desires and interests of the tribe are represented by their elected governing Council, and that the Council represents the diversity of tribal opinions.

No mitigation is proposed for Tribal Coal Only land because the tribe has decided that extraction of coal bed methane takes precedence over protecting the coal resource from the minor impacts that occur due to CBM gas development by current methods..

U9 The Study Area was selected for several reasons and in consideration of the need to focus on tribal gas-development issues. This focus, we believe, helped to sharpen the analysis and to avoid the dilution that would result from further expanding the analysis area. The selection of the Reservation boundary for the Study Area also reflects the need to address tribal sovereignty and the vastly different legal and jurisdictional issues associated with oil and gas development on and off tribal land. Chapter 1 describes the rationale for selecting the EIS Study Area.

Oil and gas development is a high priority for the tribe, and there are many areas of potential oil

and gas development that probably would not have residential development.

The SUIT does not plan to develop the eastern portion of the Reservation (see Chapter 1, Section 1.4) which, thereby, was excluded from the EIS. The area's omission from the Alternatives is in no way related to air quality issues. In fact, the eastern part of the Reservation was included in the Air Quality model.

The cumulative impacts of air emissions, water discharges, pipeline requirements, and wildlife have been analyzed in Chapter 4 of the DEIS.

U10 Interagency agreements between the State and BLM are outlined in memorandums of understanding that establish clear and consistent procedures and policies for review and evaluation of proposed well spacing, pooling, and field rule requests. These administrative matters establish government-to-government working protocols that are not subject to NEPA analysis and decision making. Nor are the orders that approve an optional well per 320-acre spacing unit subject to NEPA, since the orders per se do not approve actual development. The orders simply establish that two wells per 320-acre unit are required within parts of the Study Area, to produce the CBM gas resource most efficiently. For development actually to proceed at the increased spacing, NEPA must first be completed, if a suitable NEPA analysis has not already been prepared.

U11 Memorandums of Understanding that establish government-to-government working protocols are outside the scope of NEPA analysis and agency decision making. In terms of the product of governmental cooperation, the spacing orders established by the COGCC and BLM were the subject of numerous public forums and formal hearings, including the following:

- Public forum, Ignacio Colorado, October 6, 1998.
- Public forum, Durango Colorado, October 7, 1998.
- Mark West local public forum, Ignacio Colorado, October, 7 1999.
- Ignacio public hearing, April 4, 2000.
- Durango public hearing, April 5, 2000.

U12 Please see the responses to U10 and U11.

U13 The rights of the lessee are outlined in Section 1.6 of the EIS. All leases issued in the Study Area permit surface occupancy, and the Alternatives are built around these terms. Colorado law does not apply to development of tribal resources.

U14 We respectfully disagree. Chapter 2 and Appendix C both contain accurate descriptions of the Reasonably Foreseeable Development (RFD) scenario for oil and gas development on Southern Ute tribal land. Chapter 2 also presents a detailed description of three oil and gas

development Alternatives.

Generally speaking, the RFD assumes that, with the exception of the "fairway" area, the tribe and industry would develop all vacant well windows (please refer to Section 2.2 for a detailed description of the RFD). While this probably overestimates the number of wells that would ultimately be developed over the next 20 years, such an assumption provides a conservative margin of error for the purpose of investigating and analyzing programmatic management strategies and their consequences.

U15 An Alternative that prohibits any further CBM development represents a "straw" Alternative at best and does not address the Purpose and Need for this EIS. Some level of development is already approved through previous NEPA documents, and existing lease holders have a contractual right to explore, develop, and produce oil and gas on their lease holdings. More appropriate, at the APD submittal stage a "no action" (no drilling) Alternative is examined in detail, alongside Alternatives that would allow for well development.

The BLM has concluded that providing for a second well per 320-acre spacing unit is the most efficient spacing for CBM gas development of the Fruitland formation in the Study Area. A scenario that provides for steady state production over the next hundred years would outstrip the useful life of the gas production and transportation infrastructure, effectively rendering CBM gas extraction uneconomical, or far less economical that the current development trajectory. Incremental production curves resulting from infill production and enhanced CBM gas production are presented in Figure 2-3, 2-4, and 2-5.

U16 The BLM and BIA identified but dismissed from detailed consideration an Alternative that addressed infilling Fruitland Formation production to four wells per 320-acre spacing unit (Section 2.3.4). Production and reservoir characteristics, as they are currently understood, indicate that this well density is not optimal for the prevention of waste and maximization of ultimate recovery. The Alternative was eliminated from further detailed consideration because it is not practical or expected. If knowledge of reservoir conditions (performance) were to change, the examination of 80-acre spacing would be addressed in a subsequent programmatic NEPA document, before development at that density could proceed.

U17 Because this programmatic EIS addresses an ongoing program, it is correct to portray "no action" as the continuation of current management. This treatment of the No Action Alternative is described in the Council on Environmental Quality's Memorandum to Agencies titled "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations," which was published in the 46 Federal Register 18026 (Mar. 23, 1981), as amended.

We disagree that the statement at Section 2.4.1 is an intentional attempt to evade NEPA review. The EIS text notes that spacing orders allowing two wells per 320-acre spacing unit have been issued within the Reservation, initially for experimental purposes. This statement sets the stage

for the full analysis of the No Action Alternative, as presented in Chapters 2, 3 and 4 of the DEIS.

U18 While the 1991 EA is referenced, the No Action Alternative is fully analyzed, and the Alternative's projected environmental consequences are presented in the EIS.

U19 Infill development has been the subject of intensive feasibility studies that were fully scrutinized during COGCC and BLM technical reviews. An analysis of these feasibility studies is beyond the scope of this EIS, because the BLM and COGCC have already determined, from a reservoir-engineering standpoint, that infill wells are necessary to develop the Ignacio-Blanco Field in an efficient manner, and have issued the applicable spacing orders independently and before this EIS. The analysis of the need for infill wells to develop oil and gas reservoirs fully is a technical-engineering exercise, independent of the NEPA process. In addition, it is important to note that the decisions allowing up to four wells per section for each producing formation in the Ignacio-Blanco Field were made before the DEIS was issued. Analysis of the potential impacts of development under the approved, existing spacing orders for the Ignacio-Blanco Field is the focus of the EIS.

The economic viability of each infill well or ECBM project is determined at the permitting stage. The technical need for infill wells for development of coalbed methane in a large part of the Study Area has been previously determined by the BLM, through review of technical evidence and formal hearings in accordance with memoranda of understanding between the BLM and COGCC. The data presented at the hearings and the findings and orders of the BLM are a matter of public record and are available through the COGCC and the BLM. Because of the volume of information involved and the public availability, those data, findings, and orders are incorporated in the FEIS by reference in Section 1.3

U19A The statement in Section 2.4.2 that "The increase in wells would allow accelerated production of the resource, increase recoveries of the gas in place, and increase economic return to the lessor/royalty owner." is supported by the economic-impact analysis of Alternative 2 in Section 4.10 of the DEIS; the testimony presented during the COGCC administrative technical reviews held in 1996, 1998, and 2000 (see the response to U19); the findings and orders issued by the BLM and COGCC following those hearings; and the industry and tribe's decisions to develop wells at the increased density.

U20 The analysis of Alternative 3 in the DEIS discloses the incremental impacts of combining Alternative 2 and ECBM recovery techniques. This is a reasonable approach because ECBM without infill wells is not considered a practical scenario. ECBM is a relatively high-capital-investment technique that, to date, is considered economic only where a singe well cannot produce gas adequately in a 320-acre unit. The incremental impacts of ECBM are segregated for analysis, but injection of gases does not represent a substitute for increased density of wells, so it

was not analyzed separately as an Alternative to Alternative 2.

U21 For all intents and purposes, the environmental consequences of conventional development of the Pictured Cliff, Mesa Verde, and Dakota formations are the same. Thus the environmental consequences of conventional well production are presented with no further distinction between development of the three formations. On the other hand, there are potential differences between conventional and CBM gas development; therefore, the two extraction methods are analyzed and contrasted, where appropriate, in the EIS.

U22 The DEIS discusses and analyzes impacts from:

- Enhanced Production Techniques, Including CO2 Sequestration (Chapters 2,3 and 4)
- Cavitation (Sections 2.8.5.1, 4.5.1.3 and 4.12)
- Hydraulic Fracturing (Sections 2.8.5.1, 4.4.1.3 and 4.5.1.3)
- Recompletion (Sections 2.8.5.1 and 4.5.1.3)
- Directional Drilling (Sections 2.8.4.4 and 4.6.3.2)

Use of Industrial Exhausts as Sources of Carbon Dioxide (CO2 and ECBM is addressed in Section 2.8.5.4) CO2 is a Fruitland CBM production byproduct of ample quantity to be used as an ECBM gas.

Bioremediation is a method of reclaiming contaminated soil, not a production technique.

Drilling more wells closer together is discussed as an Alternative considered but not analyzed in detail (See Comment Response U16) because it is not generally a feasible means of mitigation for anticipated development, due to the shallowness of the coal, the need to pump water efficiently from the bottom of the well, and the widespread nature of development.

The use of low-profile tanks and other production facilities to minimize visual impacts is a mitigation measure included in Section 4.9.8. Pump selection will vary from one drill site to another, depending on a number of variables, including the amount of water to be pumped, the type of well completion, and proximity to residential sites and other sensitive resources.

U23 Compressor and treatment facility disturbance are not factors because expansion of these facilities would occur almost entirely within the existing disturbance areas–if needed (Section 4.1.3.2).

The need for expansion and modification of central delivery points is addressed in Sections 4.4.2 and 4.8.3.1.

U24 The referenced statement is based on a maximum-disturbance premise. We have revised

the section to indicate that conventional well development is considered to be distributed evenly throughout the Study Area on any open drilling windows and to have maximum possible impacts per each resource analyzed. This methodology estimates impacts conservatively for each resource, despite uncertainty concerning actual development locations. Since sites are likely to be developed only in areas with higher production potential, the actual impacts are likely to be less than predicted in the maximum-disturbance-scenario analysis.

U25 The fairway probably already contains a sufficient number of CBM wells to drain the CBM resource efficiently, so infill is not expected to be economic there(Section 2.5.2). For analysis purposes, development was considered to occur in the fairway and in the Fruitland formation near outcrop zone but at a much lower rate than in the main Study Area. "No new drilling in many if not all areas" is not a viable Alternative because existing leases and spacing orders would allow infill drilling in the Study Area.

U26 Map 3 shows available 320-acre drilling windows. The fairway area has been fully developed at 320-acre spacing, so no available windows appear on the map. Map 4 shows available 160-acre windows. The fairway area has numerous available 160-acre infill development windows, but, as noted in Comment Response U25, "for analysis purposes, development is considered to occur in the fairway and in the Fruitland formation near outcrop zone but a much lower rate than in the main Study Area." .

U27 Please see Comment Responses U24 and U26.

U28 Pad size, access road, and flowline requirements are based on the average size of disturbance for similarly constructed wells. The average-disturbance factor is based on years of experience over literally hundreds of wells, and is the minimum needed to accommodate drilling and associated equipment safely. Additionally, Section 2.5.3 and Appendix D describe how the analysis conservatively works with this factor by literally double-counting impacts where, in fact, we know they will not occur.

U29 We respectfully disagree. Decisions on well spacing are beyond the scope of this EIS (please see Comment Response U19 also). The information regarding existing spacing, location, and siting of wells is available and has been used throughout the DEIS as the basis for the impact analysis of the Alternatives. The EIS analyzes the potential impacts of development under the existing, approved spacing for the Ignacio-Blanco Field. Based on this analysis, determinations on how development would occur under these spacing orders will be documented in the Record of Decision for the EIS.

Well spacing has been established for fee mineral estate by orders issued by the COGCC and for tribal mineral estate by the BLM, following technical review of gas-reservoir data for the

Ignacio-Blanco field. The Respondent correctly notes that siting of wells within 20-acre well windows is reserved until an APD is filed.

U30 The assumptions used in the EIS analysis are, in our opinion, logical, reasonable and based on quantifiable field observations (Please see Comment Responses U-24, U-27, U-28 and U-29). The methodology for impact determination results in a conservative estimate of impacts, by effectively double-counting impacts in instances when more than one resource is represented within a well window. This impact assessment methodology is described in Appendix D of the EIS. The maps in the EIS, we believe, adequately portray and disclose the Proposed Action and Alternatives. The maps and figures have been revised to reflect information current as of August, 2001.

U31 Please see response to comment U17.

U32 Development of 269 wells is programmatically approved under the existing EA for gas development on the Reservation and is not the subject of decisionmaking in this EIS. NEPA analysis will be conducted for each individual well before approval. Alternatives 2 and 3 include this baseline of conventional development, treating it as a constant across all Alternatives, which it is.

Development of conventional wells on nontribal leases is outside the scope of this EIS. Development of both conventional and CBM wells on nontribal leases generally is within the jurisdiction of the COGCC (except where the operations are conducted by the tribe), not within the jurisdiction of Federal agencies, and would not require NEPA compliance.

U33 Please see the response to comment U-2. From a practical standpoint, the full Alternatives analyzed in this EIS are not built around each individual environmental issue and alternative approach to addressing the single issue. To do so would result on tens if not hundreds of Alternatives with little if any differentiation between each, and little if any relationship to the Purpose and Need for the study. The Alternatives are built around strategic themes and include extensive mitigation approaches.

Remediation of known problems is ongoing and has been the focus of interagency and industry cooperation for more than a decade. For example, a description of the approach used to extinguish coal fires on the Reservation is presented in the Geology and Minerals section of the EIS. These efforts are independent of the need to prepare an EIS. Drilling and production issues are analyzed and documented at length throughout the EIS (reference, for example, Section 4.5.1.3, and Section 4.5.1.8).

U34 The leasing stipulations were established before development of this EIS, and energy

development is bound by the stipulations contained in existing leases across the Study Area. Existing energy leases are binding; varying of lease stipulations is not an available option, nor does it address the Purpose and Need for the EIS.

The mitigation measures and conditions of approval in the EIS are taken from the "Best Management Practices" of the BLM, BIA, and the oil and gas industry. Additional mitigation measures are developed, analyzed, and disclosed in the DEIS, where necessary, to address the potential environmental consequences of the Alternatives. The inclusion of mitigation measures by reference is done to minimize the physical size of the DEIS.

It's not in the best interest of this analysis to analyze and discuss at length less effective or ineffective mitigation approaches. Here, we've attempted to put forth the most effective mitigation measures.

U35 Mitigation measures are not deferred to the APD stage, they are applied at both the programmatic and site-specific project level. The EIS states:

> Section 4.1.5, Mitigation Planning
> General mitigation consists of measures or techniques included as a project-wide basis as part of the Agency-and-Tribal-Preferred Alternative or alternatives. Specific mitigation includes measures that pertain to a particular resource and these are described within the resource sections. A number of standard mitigation measures currently exist that have been developed by SUIT, BIA, and BLM. These standard agency mitigation measures are provided in Appendix E. In addition, resource specialists develop mitigation measures for specific resources and projects, as needed and where appropriate. The impacts remaining after applying mitigation measures are considered residual, unavoidable impacts of the Agency-and-Tribal-Preferred Alternative or alternatives.

Mitigation measures are implemented by BIA, BLM, and tribal personnel. The BLM is responsible for mitigating downhole and surface operations directly related to downhole operations. The BIA is primarily responsible for surface impacts, including pipeline rights-of-way, and works with the BLM to monitor and mitigate surface impacts of downhole operations. tribal specialists, in addition, work with Federal employees to monitor activities and to mitigate potential impacts on the Reservation.

U36 The mitigation measures outlined in this EIS are global measures designed to address programmatic issues across the Study Area. The mitigation measures, when taken as a whole, represent the management requirements that apply to continued development of gas resources on the Reservation. We point out that additional measures would be developed and applied on a site-specific basis, as the need arises.

U37 We do not believe there is an environmental-justice issue arising from the Alternatives contemplated in this EIS, nor are we aware of any history of abuses, well documented or otherwise, of tribal or nontribal residents within the reservation. The population of the Southern Ute Indian Tribe is centralized in and around Ignacio–a relatively small area, compared with the Study Area as a whole. There are no scattered communities on reservation land. The tribal members, individually and as a whole, have benefited, and will greatly benefit, from oil and gas production in terms of per capita, annual cash dividend payments, new schools, new tribal government buildings, a community center, etc.

U38 Low-income communities are *not* common throughout the Study Area, nor are they deferentially singled out as the targets for development. On tribal land, the tribal members' homes are centralized in and around Ignacio. There are no scattered communities on tribal land.

U39 See Comment Response U38.

U40 The oil and gas industry hires and maintains operations in an area that is greater than just the Southern Ute Reservation. The five-county area was selected for evaluation of socioeconomic impacts because it covers the population that could reasonably be expected to be employed in, or otherwise economically affected by, gas-industry activities on the Southern Ute Indian Reservation land.

U41 Tribal members benefit from oil and gas production providing per capita payments, yearly cash dividends, a new tribal school, new buildings for government functions, a new community center, and a chance for tribal financial security in perpetuity. Others residing on the reservation have not been unjustly singled out as bearers of the brunt of CBM development. Development has proceeded, and will proceed, according to strict spacing rules that can result in conflict from time to time with individual land owners. In such cases the tribe or others operating on tribal leases attempt to arrive at equitable solutions to the issues at hand. But in no cases are minorities or economically disadvantaged persons being singled out as populations that would bear the consequences of CBM development.

U42 Please see Comment Response U38.

U43 We have developed and submitted a second draft of the Biological Assessment to the U.S. Fish and Wildlife Service (USFWS) for review. Formal consultation with the USFWS will be completed before issuing a Record of Decision for this Project. This is consistent with the working protocols established between the two agencies.

U44 The fact that wells have been drilled within the Study Area in the last 5 years does not change the impacts analysis and conclusions in the DEIS. The FEIS contains updated information regarding existing wells.

U45 The confined-aquifer theory is a fundamental concept in the field of hydrogeology, and has not been "widely repudiated." Specific to the Fruitland Formation, the data collected by numerous workers and published in peer-reviewed journals support the conclusion that the Fruitland Formation is a confined aquifer. While it appears that the Fruitland and Pictured Cliffs Formations are hydraulically interconnected, these formations are confined by the Kirtland Shale and the Lewis Shale. The data support the conceptual model presented in the DEIS, where the Fruitland Formation is an unconfined aquifer near the outcrop and confined about 2 miles from it. If the Fruitland Formation were in hydraulic communication with shallower aquifers deeper in the basin, there would be much less artesian pressure in the Fruitland, as the water pressures would have bled off into the shallow aquifers.

The concept of fissures, fractures, and faults providing conduits for flow between the Fruitland Formation and shallow aquifers is not supported by the data. If there were significant transport between the Fruitland Formation and the shallow aquifers, artesian pressures would not be contained down to the Mesa Mountain area, over 15 miles from the recharge areas located along the northern basin rim.

The 3M Hydrologic Modeling Study has shown that the vertical leakage of water out of the Fruitland Formation into the overlying Kirtland Shale is extremely small. In fact, the calibrated 3M model matched pressure data and recharge estimates with a zero-leakance term. Although recharge is estimated, it was well within the range of published values for semi-arid regions. An increase in the leakance term would require higher recharge values. Significant flow between the Fruitland Formation and the shallow aquifers would require unrealistically high recharge values.

Regarding the effects of CBM development on the surface drainage and runoff patterns at the outcrop, the EIS notes that evidence to date indicates that groundwater levels along the outcrop are decreasing.

The text has been revised to describe impacts observed at Soda Springs and possible impacts at other unmapped springs along the outcrop, within the SUIT Reservation. The text also notes that in the outcrop areas north of the SUIT Reservation, surface water impacts are not tied to the CBM development within the reservation, but to the development north of the reservation.

U46 Secondary biogenic gases can be generated at the Basin margins if sufficient immature organic matter remains after burial. This is unlikely to explain biogenic methane that suddenly appears in water wells, because the rate of exhumation of the outcrop is an extremely different rate (erosion rate) and because the water wells are generally too far from the outcrop to be affected by a basin margin process. While the biogenic origins can be ascribed to localized areas along the outcrop, most of the gas in the Fruitland Formation in the deep basin is of thermogenic

origin. Therefore, when methane with a biogenic signature is found in a shallow well miles from the outcrop, it is more likely to be shallow biogenic gas, not Fruitland-sourced methane.

There are many reports of shallow water wells containing methane before CBM development. The natural occurrence of methane in shallow wells should not be overlooked when evaluating the cause(s) or source(s). Biogenic methane found in water wells, however, very often has a likely domestic source nearby, such as a barnyard or septic field.

BLM has studied the biogenic vs. thermogenic origin of methane in shallow wells for years. Although not conclusive by any means, classifying methane as either biogenic or thermogenic is the best indicator we have of determining methane sources. Published literature has shown that the stable-isotope ratios can be related to biogenic vs. thermogenic sources, as well as the thermal maturity of the coal. Thus the use of biogenic testing/typing is not capricious, but is a reasonable scientific method for identifying contamination sources in this basin, and it is well supported by the empirical data.

We also note that where thermogenic gas has been found in shallow water wells, BLM and COGCC take steps to identify and remediate development-related sources.

U47 Because the details of all municipal and industrial development associated with the Animas-LaPlata project are not known, it is not possible to harmonize the Southern Ute EIS project with offshoots of the Animas-LaPlata project. The DEIS is intended to address impacts on the current landscape and any foreseeable developments, and cannot speculate on impacts on all potential development scenarios through the life of the project.

U48 Traffic-volume impacts are addressed extensively in Section 4.7, and Tables 4-37, 4-38, and 4-39 illustrate the proportion of gas-industry use of roads relative to total traffic levels for each of the three Alternatives.

U49 Native American consultation has commenced for this programmatic project, and will continue at the site-specific project stage.

U50 We believe that Sections 3.9 and 4.9 (Visual Resources) are understandable, and that these sections accurately and reasonably describe the visual-effects issues, affected environment, and environmental consequences.

U51 There are no reputable (peer reviewed) studies or even reasonable data on "socioeconomic costs of the production activities analyzed," so there are no surrogate estimates of dollar costs to assign to impacts. Economic costs with no assigned quantitative value are addressed qualitatively in the EIS.

U52 The EIS analyzes and discloses noise impacts from the Alternatives. Noise will be controlled in accordance with all applicable regulations. The tribe has implemented noise mitigation and will continue to consider mitigation of site-specific noise impacts on a case-by-case basis, as described in Section 4.11.7.

U53 Please see the following Comment Responses U73 through U78. Operators are required by strict Federal and state regulations to prevent, report, and mitigate such events, thus it is inappropriate to speculate on such events in this EIS.

U54 A description of the existing pipeline infrastructure is not included in this EIS because the main pipeline system is already in place. If new pipelines were proposed, they would be subject to a project-specific NEPA analysis. We believe that publication of the existing pipeline infrastructure would not add value to the decision-making process in this EIS. While operators would openly disclose pipeline locations at a landowner's request, most of the pipelines related to the proposed Alternatives are located on tribal, not private, land.

U55 The DEIS is concerned with effects associated with oil and gas development within the boundaries of the SUIT reservation. The described seeps are observed far north of the Study Area, on the Pine River (the northern basin). The DEIS discloses that methane seeps apparently increase due to CBM development along the outcrop within the reservation. Development in the Study Area is unlikely to affect the outcrop outside the SUIT reservation.

There is evidence that coal fires are started at the outcrop, well above the pre-development water table. There is also evidence that coal fires are part of the outcrop history before CBM development; the description of coal fires and their history has been expanded in Sections 3.4.2.1 and 3.12.8. This information points to the difficulty of determining the cause of coal fires that were observed after CBM development began in the basin, as well as the difficulty of characterizing them.

Gas development within the SUIT reservation will not affect the outcrop in areas north of it, with the possible exception of the Ridges Basin area.

Surface ownership along the Fruitland outcrop within the reservation is limited to the SUIT, along with a few private individuals. Private surface ownership on the Fruitland outcrop is less than 500 acres, in remote areas and very rugged terrain. Immediately north of the SUIT reservation, the land is owned by the Bureau of Reclamation and the State of Colorado. There are no residences or major structures in areas known to seep methane within the SUIT reservation. Because the SUIT owns the land affected by methane seepage along the outcrop, it can effectively control future development. Land ownership also allows the SUIT to reduce any serious risks associated with coal fires within the reservation. No houses are threatened by the existing coal fires on the reservation.

U56 The EIS conclusions are based on a thorough analysis of all the known and foreseeable impacts related to the proposed action and the Alternatives, using the best available information.

U57 and U58 Direct, indirect, and cumulative impacts on the environment should be analyzed for the proposed action and each Alternative, if any, to the extent necessary to determine if the impacts are significant. The cumulative-impact approach for this EIS was to determine, first, if there were significant impacts from the proposed action on the affected environment, after application of mitigation measures. The rationale for this approach is described in more detail in Section 4.1.4, Cumulative Impact Analysis. In addition, Section 4.13, Cumulative Impact Analysis, has been expanded to provide a more detailed analysis of the three Alternatives presented in the EIS.

U59 NEPA requires that Federal Agencies evaluate the potential for "significantly affecting the quality of the human environment" of a Proposed Action and Alternatives, before a decision is made to proceed with a selected activity. For those actions from which no significant impact is anticipated, the Federal Agency may conduct an "Environmental Assessment," and if no significant impacts are found, then the Agency can issue a "Finding of No Significant Impact" and a "Decision Record" and proceed with the activity. When the likelihood of a significant impact is unknown, however, the Federal Agency must prepare an "Environmental Impact Statement" to analyze and disclose any significant impacts of the Proposed Action or Alternatives, before a decision is made to approve or deny the specific activity.

In evaluating potential air quality impacts from a Proposed Action or Alternatives, the analysis may focus on the Alternative with the greatest potential for air quality impacts (for example, the Alternative with the most potential development), and if that analysis demonstrates no significant impacts are likely, then any other Alternative with less potential for air quality impacts would also not have any significant air quality impacts.

The DEIS is correct in stating that the potential air quality impacts from Alternative 1 (Continuation of Present Management) and Alternative 2 (Coalbed Methane Infill Development) "would be less than those described in Section 4.2.5 <u>Alternative 3 -Enhanced Coalbed Methane Recovery</u> below." We do not expect either of these Alternatives to have any significant adverse air quality impacts.

U60 Potential mitigation measures were *not* "avoided and delayed" in the DEIS. Numerous potential air quality mitigation measures were clearly listed on pages 4-22 through 4-25 of the DEIS (Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.8 <u>Mitigation Summary</u>).

As described in Comment Response A1, the requirements under NEPA for environmental impact analysis, disclosure, commenting, and response are separate from either the land management

decision process ("record of decision") or the Clean Air Act regulatory process. Federal land management agency decisions must ensure continued compliance with all local, state, tribal, and Federal air quality laws, statutes, regulations, standards, and implementation plans. These agencies also have discretionary authority to include operational stipulations in a "record of decision" to limit potential environmental impacts. Since no significant air quality impacts were identified in the DEIS for any Alternative in the three analyzed emission-rate scenarios, however, there is no basis for incorporating additional mitigation measures.

Requirements for reviewing and authorizing specific air pollutant emission sources under the Clean Air Act ("permitting") are the responsibility of the EPA (either directly or thorough oversight of delegated authority to applicable air quality regulatory agencies). The Respondents should contact the EPA (or the applicable air quality regulatory agency) if they believe required air pollutant emissions permits are not being administered correctly.

Please also see Comment Responses O4 and O5.

U61 The Respondent's assertion that "each APD will thus be required to examine the cumulative impacts of the oil and gas program, perhaps requiring a full EIS for each APD" is erroneous.

As clearly stated in the DEIS (page 1-4; Chapter 1; 1.3 PURPOSE AND NEED), one of the goals of the DEIS is:

- "To provide a programmatic NEPA document from which to tier future site-specific environmental analyses of development proposals."

In fact, pages 1-10 through 1-11 of the DEIS (Chapter 1; 1.8 AUTHORIZING ACTIONS) detail just how site-specific environmental impact assessments would be required, once a lessee or operator submitted an APD, and how that analysis would be tiered to the Final programmatic EIS.

U62 As stated in the DEIS (page 4-9; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery): "No violations of applicable state, tribal or Federal air quality regulations or standards are expected to occur as a result of direct, indirect, or cumulative [emphasis added] CBM development-related air pollutant emissions (including construction and operation)."

U63 Since the air quality Study Area is classified as either "attainment" or "unclassifiable" for all criteria pollutants, and all HAP emissions would be below EPA's National Emission Standards for Hazardous Air Pollutants (NESHAPS) *de minimis* level (10 tons per year for each individual HAP), there are no "legally allowable" emission limits in the area.

U64 No "unregulated substances" would be released into the air from the Proposed Action or Alternatives that would have a significant direct or cumulative impact on air quality.

U65 As stated in the DEIS (page 2-38; Chapter 2; 2.7 COMPARISON OF ALTERNATIVES; Summary of Resource Comparisons): "Air Quality - Significant impacts on air quality are not anticipated with the development of any of the three alternatives."

Therefore, based on the detailed air quality impact analysis described in the DEIS, the Proposed Action or Alternatives could proceed without precluding other emission sources, either already accounted for in Chapter 3 - Affected Environment, or reasonably foreseeable emission sources included in the cumulative-impact assessment.

Of course, there is no scientific or legal basis for analyzing potential air quality impacts from unforeseen (not anticipated) "future emissions by other sources."

U66 We expect no significant impacts on air quality with the development of any of the three Alternatives, either directly or in combination with other reasonably foreseeable emission sources included in the cumulative-impact assessment.

Potential cumulative air quality impacts were presented in detail in the DEIS (pages 4-12 through 4- 22; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; Section 4.2.7 Cumulative Impacts). Given the "programmatic" nature of this air quality impact assessment, however, specific cumulative impacts at specific residence locations can not be determined.

U67 The maximum potential air quality impacts predicted during construction would not occur once the limited 36-day construction period is complete at each well location. Similarly, the maximum potential air quality impacts predicted during operation would not occur after the 20-year LOP.

U68 The statement, "based on estimates of likely locations of wells..." describes the fact that we know the locations of well windows and the vegetative characteristic of each window, which, in turn, allows for quantification of impacts. Quantification of the extent of weed infestations, on the other hand, is difficult because of the patchy and fluctuating occurrence of such infestations. It is sufficient to say that weeds can be a problem wherever soil is disturbed, and that it is BIA and tribal policy to control weeds aggressively.

U69 Although the spread of noxious weeds can result from construction and production phases of any of the Alternatives, the application of the mitigation measures in Section 4.3.1.8 would significantly lower the potential rate of spread. The BIA and tribe require operators to control noxious weeds in project areas and to use seed that is certified free of noxious-weed seed for

reclamation.

U70 Current vegetation die-offs due to methane seeps stemming from CBM development on the SUIT Reservation are limited to relatively small areas (several acres or less) situated directly on the Fruitland outcrop. The outcrop through the western portion of the Study Area averages about ¼ mile wide, and about 16 miles of outcrop is within the Study Area. The coalbeds make up about 25% of the Fruitland Formation, and methane seeps with associated die-offs have been observed only directly over coalbed outcrops. Methane seeps occur in only about 50% of the coalbeds, or less. Therefore, the maximum affected area would be approximately ½ square mile, or 320 acres (.25 miles wide x 16 miles long = 4 square miles x .25 x .50 = ½ square mile). Assuming all coalbeds can seep methane at rates sufficient to kill the overlying vegetation, then a maximum of 1 square mile, or 640 acres, could be affected in the Study Area.

U71 There are no demonstrated vegetation impacts from emissions related to compressors and pumping units. Emission rates are minimal and distributed over a wide area (Section 4.2). No other discharges occur under normal operating conditions. All produced water is piped or trucked offsite and reinjected, or evaporated in lined ponds. The BLM, BIA, and tribe are not aware of illegal dumping. Illegal dumping occurring in the future would be a matter of investigation and prosecution, but is not an issue that drives the Alternatives analyzed in this EIS.

U72 Cumulative impacts are discussed in detail in Section 4.13.

U73 A "Hazardous Materials Summary" has been included in the FEIS as Appendix P. Any potential impacts, including cumulative impacts, from hazardous materials related to the Project are expected to be insignificant, because of the strict regulations governing the transportation, use, and storage of hazardous materials.

U74 Sections 3.12.4, 3.12.5, 4.5.1.3 and 4.12.2 have detailed descriptions of the handling, storage, transportation, and use of hazardous and nonhazardous materials and wastes, as well as descriptions of the management of potential and actual spills of wastes or chemicals associated with the Project.

U75 Since the produced natural gas would be nearly pure methane and ethane, no significant HAP emissions would occur during construction or operation, although CBM recovery wells, injector wells, and pipeline compressor engines would emit small amounts of formaldehyde. Please also see Comment Response H2.

As described in the DEIS (page 4-12; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 <u>Alternative 3 - Enhanced Coalbed Methane Recovery</u>) and detailed in the "Air Quality Impact

Assessment Technical Support Document" (pages 55 through 60; Dames and Moore 2000), the construction and operation of potential well development (assumed to occur on 160-acre spacing) would not exceed short-term HAP Acceptable Ambient Concentration Levels, nor exceed long-term incremental cancer risk thresholds.

U76 The Clean Air Act established National Ambient Air Quality Standards for the following chemicals, compounds, and groups of compounds, and their potential impacts on air quality were specifically analyzed in the DEIS (pages 3-2 through 3-9; Chapter 3; 3.2 AIR QUALITY AND METEOROLOGY; and pages 4-7 through 4-25; Chapter 4; 4.2 AIR QUALITY AND CLIMATE): carbon monoxide, lead (including tetraethyl lead), nitrogen dioxide, ozone (including VOC precursors), particulate matter, and sulfur dioxide.

As also stated in the DEIS, since the produced natural gas would be nearly pure methane and ethane, no significant HAPs emissions (including BTEX; benzene, toluene, ethylbenzene, and xylene [ortho-, meta-, or para-xylene]) would occur during construction or operation of the Proposed Action or Alternatives. However, CBM recovery wells, injector wells, and pipeline compressor engines would emit small amounts of formaldehyde (a listed HAP). Maximum formaldehyde impacts were described in the DEIS (page 4-12; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery).

None of the following chemicals, compounds, and groups of compounds are listed as a HAP by the Clean Air Act: acetone, aluminum (or aluminum compounds; including aluminum oxide), ammonium bisulfate, ammonium hydroxide, ammonium nitrate, ammonium *peroxy*disulfate (a.k.a. ammonium persulphate), ammonium sulfate, barium (or barium compounds), calcium hydroxide, copper (or copper compounds), iso-butyl alcohol, potassium hydroxide, sodium hydroxide, sodium nitrate, sulfur trioxide, 1,2,4-trimethyl benzene, zinc (or zinc compounds, including "basic zinc carbonate"), zirconium nitrate, or zirconium sulfate.

The following chemicals, compounds, and groups of compounds are listed as HAPs by the Clean Air Act, but *none* would be emitted above EPA's National Emission Standards for Hazardous Air Pollutants (NESHAPS) *de minimis* level (10 tons per year for each individual HAP). Therefore no significant air quality impacts would occur from these HAPs during construction or operation of the Proposed Action or Alternatives.

The following HAPs classifications were obtained from EPA's "Health Effects Notebook for Hazardous Air Pollutants" (www.epa.gov/ttn/atw/hapindex.html):

- acrylamide - EPA has classified acrylamide as a Group B2, probable human carcinogen of medium carcinogenic hazard.

- arsenic (and arsenic compounds) - EPA has classified inorganic arsenic as a Group A, human carcinogen of high carcinogenic hazard.

- cadmium (and cadmium compounds) - EPA has classified cadmium as a Group B1, probable

human carcinogen of medium carcinogenic hazard.

- carbon disulfide - EPA has classified carbon disulfide as a Group D, not classifiable as to human carcinogenicity, due to a lack of adequate data.

- carbon tetrachloride - EPA has classified carbon tetrachloride as a Group B2, probable human carcinogen of low carcinogenic hazard.

- chromium (and chromium compounds) - EPA has classified chromium (VI) as a Group A, human carcinogen of high carcinogenic hazard, and chromium (III) as a Group D, not classifiable as to carcinogenicity in humans.

- cumene - EPA has not classified cumene with respect to potential carcinogenicity.

- glycol ethers - No information is available on the carcinogenic effects of the glycol ethers in humans. EPA has not classified the glycol ethers for carcinogenicity.

- n-hexane - No information is available on the carcinogenic effects of hexane in humans or animals. EPA has classified hexane as a Group D, not classifiable as to human carcinogenicity.

- manganese (and manganese compounds) - No information is available regarding the carcinogenic effects of manganese in humans, and animal studies have reported mixed results. EPA has classified manganese as a Group D, not classifiable as to carcinogenicity in humans.

- mercury (and mercury compounds) - EPA has classified inorganic mercury and methyl mercury as Group C, possible human carcinogens, and elemental mercury as Group D, not classifiable as to human carcinogenicity.

- methanol - No information is available on the carcinogenic effects of methanol in humans or animals. EPA has not classified methanol with respect to carcinogenicity.

- methyl ethyl ketone - EPA has classified methyl ethyl ketone as a Group D, not classifiable as to human carcinogenicity.

- methyl *tert*-butyl ether - No information is available on the carcinogenic effects of methyl *tert*-butyl ether in humans or animals. EPA has not classified methyl *tert*-butyl ether with respect to potential carcinogenicity.

- napthalene - EPA has classified naphthalene as a Group D, not classifiable as to human carcinogenicity.

- nickel (and nickel compounds) - EPA has classified nickel refinery dusts and nickel subsulfide as Group A, human carcinogens. EPA has classified nickel carbonyl as a Group B2, a

probable human carcinogen.

- POM (polycyclic organic matter; a.k.a. polynuclear aromatic hydrocarbons, or PAH; including Coal Tar Pitch - Organic compounds with more than one fused benzene ring, and which have a boiling point greater than or equal to 100° C. EPA has classified benzo(a)pyrene (a component of polycyclic organic matter) as a Group B2, probable human carcinogen of medium carcinogenic hazard.

- Radionuclides (including radium 226 and uranium) - EPA has classified radium as a Group A, human carcinogen, however EPA has not classified radon or uranium for carcinogenicity.

- selenium (and selenium compounds) - EPA has classified elemental selenium as a Group D, not classifiable as to human carcinogenicity, and selenium sulfide as a Group B2, probable human carcinogen.

- 1,1,1-trichloroethane (a.k.a methyl chloroform) - EPA has classified 1,1,1-trichloroethane as a Group D, not classifiable as to human carcinogenicity, based on no reported human data and inadequate animal data.

None of the following "hazardous substances" are chemicals, compounds, and groups of compounds listed in the "Handbook of Chemistry and Physics" (published annually by the CRC Press, Inc. Boca Raton, Florida): Cyclohexene ethylbenzene, Dianiline, Diathonolamine, Dodecylbenxenesolfonic acid, Ethylene diamine tetra, 4-4 methylene, Nitroloriacetic acid, Propolene, or benzene formaldehyde (although potential impacts from the separately listed HAPs, benzene and formaldehyde, were analyzed in the DEIS as described above).

The following similarly named chemicals, compounds, and groups of compounds are *not* listed as HAPs by the Clean Air Act: cyclohexene, dichloroacetic acid, dodecylbenzene sulfonic acid, ethylenediamine tetraacetic acid (EDTA), nitrilotriacetic acid (NTA), and propylene.

The following similarly named chemicals, compounds, and groups of compounds are listed as HAPs by the Clean Air Act, but *none* would be emitted above EPA's National Emission Standards for Hazardous Air Pollutants (NESHAPS) *de minimis* level (10 tons per year for each individual HAP). Therefore no significant air quality impacts would occur from these HAPs during construction or operation of the Proposed Action or Alternatives.

The following HAPs classifications were obtained from EPA's "Health Effects Notebook for Hazardous Air Pollutants" (www.epa.gov/ttn/atw/hapindex.html):

- aniline -EPA has classified aniline as a Group B2, probable human carcinogen of low carcinogenic hazard.

- chloroacetic acid - No information is available on the carcinogenic effects of chloroacetic acid in humans. EPA has classified chloroacetic acid as a Group D, not classifiable as to human carcinogenicity.

- diethanolamine - No information is available on the carcinogenic effects of diethanolamine in humans or animals. EPA has not classified diethanolamine for carcinogenicity.

- ethylbenzene - EPA has classified ethylbenzene as a Group D, not classifiable as to human carcinogenicity.
- 4,4-Methylenebis(2-chloroaniline) (MBOCA) - EPA has classified MBOCA as a Group B2, probable human carcinogen of medium carcinogenic hazard.

- 4,4-Methylenedianiline (MDA) - No information is available on the carcinogenic effects of MDA in humans. EPA has not classified MDA for carcinogenicity.

- 4,4-Methylenediphenyl isocyanate (MDI) - No information is available on the carcinogenic effects of MDI in humans or animals. EPA has not classified MDI for carcinogenicity.

- propylene oxide - EPA has classified propylene oxide as a Group B2, probable human carcinogen of low carcinogenic hazard.

U77 Please refer to Appendix P for the approximate quantities of various substances, including hazardous materials, potentially used or produced on a per-well basis.

U78 The DEIS presented two different potential incremental cancer risks for the maximum predicted formaldehyde concentrations, based on the unit risk factor developed by EPA, as reported in its "Integrated Risk Information System Database:" the Maximally Exposed Individual (or MEI) and the Most Likely Exposure (MLE) analysis. The EPA procedures do not assume separate potential unit risks based on age, but the incremental cancer risks are dependent on distance and duration of exposure (e.g., "work outside the home" or "work inside the home"). EPA has developed a good description of how risks from hazardous air pollutants are assessed, titled "Risk Assessment for Toxic Air Pollutants: A Citizen's Guide" (www.epa.gov/ttn/atw/3_90_024.html).

As stated in the DEIS (page 4-12; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery) for both the MEI and MLE analyses:

> ...the predicted incremental cancer risks for the inhalation pathway all fall below or at the lower end of the 1×10^{-6} to 100×10^{-6} threshold range. Given the conservative nature of these analyses, the predicted exposures are likely to overstate actual exposures, and the potential incremental cancer risks would not be significant.

U79 Oil and gas development on the Southern Ute Reservation affects the nearby outcrop groundwater flow system in the Indian Creek Area. CBM wells in the Indian Creek Area

intercept the 37 acre-ft/yr of groundwater that would normally discharge into the Animas River or Basin Creek. This produced water is disposed of by injection into deep formations or evaporation ponds. The effects of this loss of surface water flow are discussed in Appendix G - the Biological Assessment.

U80 The Colorado Division of Wildlife and SUIT provided the game range maps that are the sources of wildlife range data (Sections 3.3.3.1 and 3.3.3.2). Wildlife range descriptions are presented in Table 3-6 and wildlife range is displayed in Map 7.

The current wildlife range disturbance estimate is based on the analysis of existing range in relationship to the location of available well windows. The methodology is described in detail in Section 4.13.3.2.

U81 Table 4-52 presents the amount of habitat, by range type, within the Study Area. The percentages given in the Table are the percentage of each habitat impacted, not the absolute amount of each habitat disturbed in relationship to the entire Study Area. Therefore, we believe the comparison does not water down effects. The cumulative-effects section also describes wildlife effects north of the Study Area, thus broadening the analysis to include the full range of habitat that may be affected by CBM gas development activities in the northern San Juan Basin

U82 We have located the area of impact down to a 20-acre well window. The actual location of impact within the well window is not known until onsite reviews are conducted at the point that APDs are filed. This is consistent with staged NEPA and the level of detail appropriate to the programmatic decisions addressed in this EIS.

U83 Mitigation measures are based on what we consider to be the most effective mitigation approach. We have not listed measures considered to be partially effective or ineffective because doing so would add little to the public's understanding of the proposed action and its impacts. Wildlife mitigation measures are presented in Section 4.3.2.8. These measures were developed specifically for this EIS but in some cases overlap mitigation that may have been presented in 1991. Where overlap occurs, it is simply because the majority of mitigation is time tested and has become a standardized tool for impact avoidance or reduction. One such example is avoidance of wetlands.

U84 The causes and extent of habitat fragmentation are discussed in Sections 4.3.2.3 through 4.3.2.7 and in Section 4.13.3.2.

U85 The statement reflects the fact that elk do not react positively to human disturbance. The physiologic and behavioral responses of wildlife are summarized in studies referenced in Section

4.3.2.3 of the EIS. The CDOW does not maintain a time series database that correlates winter mortality to meteorological variables.

U86 and U87 The habitat-disturbance effects of CBM development within the Study Area can be predicted with some degree of confidence. We cannot predict quantitatively, however, the effects of habitat disturbance on deer and elk mortality.

U88 Section 4.3.2.6 describes impacts on songbirds and waterfowl known to frequent the Study Area. Also, please see the response to U89.

U89 The Migratory Bird Treaty Act (MBTA) does not apply to the programmatic actions analyzed in this EIS. The guidelines established by the MBTA would apply at such time as an APD is filed and site-specific, NEPA-compliant documentation and field siting of well facilities are conducted for individual actions. The general mitigation measures outlined in Section 4.3.2.8 present the overall guidelines to be used for gas developments in various habitats. Additional specific mitigation is established at the project level to address site-specific issues as they arise.

U90 These effects are described in Section 4.13.3.2. and Table 4-52.

U91 The interdependence and interrelationships between ecosystems are determined by natural ecosystem dynamics and do not change. If the question is how CBM development affects various ecosystem components, please refer to Chapter 4 in its entirety.

U92 We have drafted the final Biological Assessment based on previous comments and resubmitted it for U.S. Fish and Wildlife Service (USFWS) review and concurrence. We will complete formal consultation with the USFWS before issuing a Record of Decision for this Project. This is consistent with the working protocols established between the two agencies.

U93 Table 4-52 should not match the statistics presented in Table 4-8 through Table 4-13, because Table 4-52 presents cumulative-impact statistics from both Federal and non-Federal wells, whereas the other tables present statistics from wells under Federal jurisdiction only. Sections 4.1.3.2 and 4.1.4. present the methods of calculating surface disturbance.

U94 Section 4.13, Cumulative Impact Assessment and Appendix G, Biological Assessment, have been revised in the FEIS to provide a more detailed analysis of cumulative impacts on biological resources and TES species.

U95 The Biological Assessment is presented in Appendix G.

The significance criteria presented in Section 4.3.3.1 explain that impacts would be considered significant if there were a loss of an individual plant or animal, or a loss of critical habitat of such species. There is nothing in this statement that implies that various forms of illegal take of Threatened or Endangered (T&E) species would be allowed in violation of Section 9, ESA requirements. Nor is anything described in the proposed action that would imply intention to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" Threatened or Endangered wildlife or plants.

The Biological Assessment and formal USFWS Biological Opinion address the potential adverse consequences of the proposed action and the ways in which impacts can be removed or minimized. The consultation process, and conclusions reached, eliminate illegal taking as a consequence of this programmatic action. Additionally, further analysis and consultation, if warranted by the results of the site-specific Biological Assessment, would take place when individual projects were proposed. We have rewritten Section 4.3.3.1 to more clearly state the broader definition of "take" presented in the ESA.

U96 Biological Assessments have been prepared for all Federal actions on the Reservation. The determinations reached in the BAs would not suggest that a taking is occurring. The USFWS is consulted in instances when a "may affect" determination is reached.

U97 We have rewritten Section 4.3.3.9 to state that "...conditions of approval are designed to protect Federal threatened and endangered species to ensure that actions are not likely to jeopardize the continued existence of any threatened or endangered species or result in destruction or adverse modification of (its) habitat."

This EIS conforms with ESA and ESA procedural requirements. Please refer to the Biological Assessment in Appendix G.

U98 This EIS conforms with species conservation recovery efforts. Please refer to the Biological Assessment, Appendix G, and in particular the USFWS Biological Opinion. Additionally, the BLM and BIA would develop biological assessments and tailor management practices to conform with species conservation recovery efforts when developing site-specific projects.

U99 Water sampling in the Pine, LaPlata, and Animas Rivers indicates that selenium levels are low and well within State water quality standards (Section 3.5.2.4). Section 3.5.2.4 presents a discussion of selenium levels and their sources in local riverine systems; none of the sources are

related to gas well development and production. Direct and indirect impacts on surface waters within the Study Area related to implementation of the Alternatives are expected to be negligible (please reference Section 4.5.2.7 and Biological Assessment of the effects of the proposed action on razorback sucker and Colorado pikeminnow).

In terms of the effects of disposal water, the geologic setting is not favorable for significant interaction to occur between injected disposal water and surface streams, because of the relative depth of the injection formations and low permeability of the Kirkland shale that directly overlays the formations.

The potential for direct impacts on surface water quality is a function of surface water runoff and erosion control and management practices. The mitigation measures presented in Section 4.5.2.8 and Appendix E are designed to prevent erosion from entering area streams, and therefore to minimize the risk of metal-bearing sediments reaching stream channels.

Regarding the effects of road dust, particulate matter would be controlled by application of water and/or chemical dust suppressants (Section 4.2.5), and thus would not be expected to contribute selenium to stream courses, if indeed selenium were present in the road dust.

U100 There are no studies of cross-beak birth defects specific to the Study Area that we know of. No processes associated with CBM well construction and production would contribute to increased selenium levels.

U101 The Biological Assessment makes note of the fact that individual willow flycatchers were found near Pastorius Reservoir in the north central region of the Study Area in 1995. Surveys will be conducted in suitable habitat before any construction activities, to determine the presence or absence of the willow flycatcher (Biological Assessment, Appendix G).

U102 Please refer to the Biological Assessment (Appendix G).

U103 The Biological Assessment presents a quantification of instream water depletions. These depletions may adversely affect the Colorado pikeminnow and razorback sucker. Mitigation designed to offset these adverse effects will be developed during consultation required by Section 7 of the Endangered Species Act, as amended (16 U.S.C. 1531 et seq.). Any such mitigation would be implemented in accordance with the USFWS Recovery Implementation Program for the San Juan River.

U104 CBM development, like numerous other activities in the Study Area, such as irrigation and domestic water consumption, contributes to depletions of surface water that would otherwise be available as instream flows. EIS Sections 4.3.2.3 and 4.3.3.3, and the Biological Assessment

describe how CBM development may affect local and downstream fish species, and the mitigation that would reduce or minimize potential impacts.

U105 The effects of CBM development on eagle and southwest willow flycatcher are described in the Biological Assessment and Sections 4.3.3.3 and 4.3.3.4. Mitigation in wooded riparian and wetland habitats includes avoidance of such habitats whenever possible (Section 4.3.1.8). If wetland avoidance is not possible, the BIA would consult with the Army Corps and the USFWS regarding mitigation options and obtain any necessary approvals.

U106 The responsible agencies consult at two stages, first for this programmatic EIS (see Appendix G, Biological Assessment), and again at the site-specific project stage if the results of the site-specific biological assessment trigger further consultation.

U107 The 20-year life of the project is not arbitrary; it is based on reasonable, foreseeable future development associated with the project. Although many wells may produce longer than 20 years, many others would be plugged and abandoned in that time frame. Given the changes in oil and gas markets, projection beyond 20 years is not practical.

The DEIS discloses the expected increased gas production associated with three Alternatives over the next twenty years. With each scenario, there is a significant increase in incremental gas production over the current production. For example, with no infill development (Alternative 1), there is an incremental increase in CBM production of 920 Bcf. With infill development (Alternative 2), the incremental CBM increase is 1,182 Bcf. The Preferred Alternative (Alternative 3) yields an incremental increase of 1,304 Bcf over the next 20 years.

The BLM's assessment of the need for infill wells in the Fruitland shows that infill development is required to produce the additional gas; it is not a justification for acceleration of production.

A typical engineering practice is to design pipelines, wells, and associated equipment for a 20- to 30-year project life. After this period, pipelines, wells, and equipment may require large investments to replace and repair. At such a point in the gas field's production life, an operating company is faced with a scenario in which the production has dropped dramatically, and declining production may force the abandonment of the wells and pipelines, rather than the choice of investment to replace and repair. If an operator cannot make a reasonable rate of return on his investment for replacing and repair of the infrastructure, he would leave a significant amount of gas in place that could not be recovered economically. Given these conditions, the BLM concluded that downspacing is necessary to optimize, not accelerate, recovery of the gas resource.

U108 Please see Comment Responses H1, H2 and H3.

U109 As noted in response to Comment U-55, coal fires have been a natural occurrence along the Fruitland outcrop for many years before CBM development. Stating that CBM development is the cause of all new coal fires may not be accurate.

At least one new coal fire has started very near the surface, well above the water table, and beyond any effects of CBM development.

The SUIT spent over $1,000,000 to test a technology for extinguishing coal fires. This is a significant investment to mitigate a possible CBM impact. Although this attempt was unsuccessful, the SUIT is still open to new technologies for extinguishing coal fires.
The BLM and SUIT spend at least 6 days every month monitoring the Fruitland outcrop. The monitoring is intended to identify new coal fires and monitor the magnitude on the surface of known coal fires. Estimating the subsurface extent of coal fires is not feasible.

SUIT land ownership covers almost the entire Fruitland outcrop on the reservation. Therefore, exposure to hazards associated with any CBM-induced coal fire can be minimized.

U110 The 3-M study is not an industry-conducted project. Industry was asked to provide data and invited to participate in the technical working sessions. Funding, supervision, and technical direction for the 3-M project came from the COGCC, BLM, and SUIT. The actual modeling was conducted by an independent, third-party contractor.

U111 The economics of resource recovery has been studied and presented in the EIS. Please refer to Section 4.10.

U112 There are no foreseeable economic benefits associated with delaying recovery. Gas prices have increased, but recent analyses indicate that the prices of today will remain relatively stable for years to come. These prices would support development of the resource, only if this development can use the existing gathering infrastructure. Leaving gas for future recovery is not viable. Production rates would be too low to support the cost of drilling new wells and installing new gathering infrastructure.

U113 Production projections are presented in Figure 2-3.

U114 Accelerated water removal from the Fruitland Formations would not affect the subsurface ecosystem.

U115 More efficient desorption and migration of methane associated with the proposed action would lead to an increase of 1.3 Tcf recoverable reserves.

U116 There would be no subsurface-ecosystem changes in overlying formations, due to the impermeable nature of the Kirtland shale. The Pictured Cliffs Formation, underlying the Fruitland Formation, would be partially dewatered with free gas in places. The Fruitland Formation would be dewatered, with free gas emplaced in the coalbeds and in some of the intervening sand and mudstone.

U117 Existing soil conditions are discussed in Section 3.4.3. Impacts to soils were analyzed and discussed in Section 4.4.2. Map 13 shows the soil types in the Study Area. Specific examination of soil type and potential impacts will be done on a case-by-case basis when individual projects are proposed. This staged approach to NEPA documentation and project planning is more efficient, avoiding unnecessary surveys at the programmatic level when the locations of specific activities are still unknown. Full NEPA study at the APD stage would involve full and careful on-site examination of soil type, impacts, and mitigation. The EIS emphasizes "Best Management Practices" (BMPs) to mitigate soils impacts.

U118 Please see the response to comments N4, U3, and U30, and Table 4-18 in the DEIS. In addition, the DEIS at Section 4.4.2.3 (Impacts Common to All Alternatives), states:

> In areas where soils have high to severe erosion potential (Map 14) and are unstabilized, disturbance could result in accelerated erosion to the extent that damage to facilities and roadways may occur. The soils with high to severe erosion potential (Map 14) generally occur in broad portions of the south-central to southwestern regions as well as the eastern third of the Study Area. Slope instability or mass wasting could damage facilities and possibly cause hazardous situations. No specific areas of slope instability or failure have been identified in the Study Area; however, the potential for instability typically exists where slopes are greater than 30 percent. Such steep slopes do occur in the Study Area, typically encompassing the area of the near outcrop zone and within two miles west of the near outcrop zone. Project activities should have minimal effect on slope stability because surface disturbance on slopes in excess of 30 percent would be avoided where possible. Where such disturbances cannot be avoided, mitigative measures required by SUIT, BIA, and BLM through the APD authorization process would be implemented to reduce erosion and protect watershed resources.

U119 These mitigation approaches are properly adapted at the site-specific project level. Additionally, we believe that the standard operating procedures that call for minimizing ground disturbance, reclaiming disturbed areas adjacent to roads and well pads, using well construction methods that protect soils, and utilizing Best Management Practices, together provide an effective management approach, and, as such, there is no need to examine alternatives to these

mitigative procedures in this document. The soils Mitigation Summary (Section 4.4.2.8, pg. 4-95) outlines Federal legislation regarding the protection of soils and prime farmland as well as the relevant authorizing agencies. The standard mitigation measures outlined in Onshore Order No. 1 (download from http://www.co.blm.gov/oilandgas/oilgas.htm) and standard SUIT/BIA conditionals of approval provide additional measures to reduce environmental impacts from oil and gas activities. Appendix E includes existing environmental-protection measures related to the Study Area.

U120 The use of the referenced significance criteria is neither unsupported nor arbitrary. The 5 percent threshold of significance was based on studies of predicted losses of prime farmland acreage due to urban development in other portions of Colorado, because there are no studies available that analyze loss of prime farmland from oil and gas development activities. Regardless of the significance threshold, the maximum of 3/10 of 1 percent of prime farmland that would be impacted as a result of the preferred Alternative is clearly insignificant. This small amount of predicted disturbance of farmland is due to the tribe's policy of avoidance of such resources.

U121 Methane seeps are both natural and man-made. The man-made ones are linked to CBM development in the Study Area. The long-term effects of methane-saturated soil are unknown. Historic seeps in the region (Archuleta and La Plata Counties, Colorado) are natural, and vegetation does not grow over them as long there is an active emission of methane. Given the persistent nature of these natural seeps, the man-made seeps may persist indefinitely.

U122 The most likely cause of topsoil contamination associated with production-related activities would be accidental releases of petroleum products and produced water or other hazardous materials. Because industry follows diligent operating procedures, however, such accidental releases should be rare and very localized, and therefore not quantifiable. Also, the minimal number of wells anticipated in this area and the application of mitigative measures and monitoring would render the loss of topsoil minimal. No data are currently available regarding the depth of possible soil contamination, making it impossible to determine volumes.

U123 Irrigated soils downstream are not affected because there are no anticipated releases of CBM produced water, and air emissions consist solely of gases and minimal amounts of particulate matter.

U124 It is unclear from the comment what has been or would be dumped and released. The BLM, BIA, and tribe are unaware of any illegal dumping, therefore they have no data to disclose. If a situation arose when dumping occurred, actions would be taken to clean up the site.

U125 This is not quantifiable. The BLM, BIA, and SUIT require implementation of Best Management Practices (BMPs) to reduce the impacts on topsoil. Examples of these measures include stockpiling and reuse to minimize the loss of topsoil. Other measures are listed in Section 4.4.2.8 and Appendix E of the EIS.

U126 Additional mitigation measures required to minimize erosion are evaluated on a case-by-case basis and could include the use of larger culverts and gabion (stone) fencing.

U127 Maximum potential impacts on prime farmland are presented in Table 4-19. Livestock-grazing impacts are addressed in Section 4.6.6.2. Acreage used for gardening would not be impacted. The 3M Study does not provide a quantification of methane-saturated soils.

U128 Federal land will not be crossed to access tribal land, therefore there will be no impact.

U129 None of the project Alternatives involve removal or loss of land currently used for organic farming, personal-use gardening, or production for local distribution. Personal-use gardening and production for local distribution are very limited in the Study Area, and, according to the Colorado Dept. of Agriculture, there are no certified organic licensees within the Study Area.

U130 and U131 As displayed in Table 3-50 of the DEIS, the hydraulic fracturing ("fracing") fluids referred to here are listed in the broad category of Resource Conservation and Recovery Act (RCRA) exempt wastes. They are also addressed in Chapter 2, Section 2.8.5.2. Fracing in the Fruitland formation is a straightforward process of mixing a fracing fluid of fresh water, sand, and a small amount of gel to hold the sand in suspension. Some operators add a small amount of formic acid or hydrochloric acid, to break down clays that may be present in the wellbore. The extensive monitoring efforts to date by BLM and COGCC have shown no elements of these compounds in any of the water tested. To expand these references, a more comprehensive list has been added to Appendix P.

U132 We have expanded the discussion of cavitation in Section 2.8.5.1. The hybrid fracturing process referred to has not been encountered to date, nor has any operator indicated interest in using a hybrid.

U133 The effects of poorly cemented wells, as well as the ongoing monitoring and mitigation programs, are described in detail in Chapter 4: 4.5.1.3 Impacts Common to All Alternatives, Production Phase. In the Study Area, 100% of the pipelines and compressor stations are cathodically protected through the use of an impressed-current system. Cathodic-protection wells are limited and do not pose a threat to groundwater. There is little known use of cathodic

protection on producing wells in the Study Area.

U134 BLM has no jurisdiction over COGCC utilization of staff. BLM places a high priority on ensuring that the drilling and completion of wells is in compliance with all regulations and policies. Problems and deviation from these regulations and policies are corrected immediately. All bradenhead reports are reviewed annually, and those conditions that fall outside acceptable standards are remediated immediately.

U135 The DEIS states that, based on current water production and capacity, the current number of disposal wells should be able to handle future water disposal. Section 2.8.5.3 also indicates that very few, if any, additional disposal facilities would be necessary. These conclusory statements are based on current water production and injection well capacity information.

U136 This situation occurs north of the Study Area. The hypothesized cause-and-effect relationship between the effects observed at Hickerson Hot Springs and operation of the Simon Land and Cattle Co. disposal well, although strong circumstantially, has not been proved conclusively. In reviewing the remaining injection wells, no unacceptable effects have been detected as a result of their operation.

U137 The EPA indicates that the violation has been corrected (the well was plugged back and is injecting at a different interval), and that the cause of the injection-pressure increase was operational (downhole mechanical) in nature. The reservoir was not fractured, nor was its capacity exceeded. The EPA monitors all injection wells closely, to ensure that reservoir capacities and pressure are not exceeded.

U138 The potential impacts of wells that are not properly plugged and abandoned would be similar to those associated with an improperly cemented well, as described in Chapter 4, Section 4.5.1.3. The effects of drilling additional wells are well documented throughout the DEIS, as are the actions required to mitigate any impacts.

U139 Injection pressures of injection gas would be controlled to stay well below formation parting pressure (Section 4.5.1.6). Little, if any, potential exists for the vertical migration of methane, nitrogen, or carbon dioxide from the Fruitland Formation, due to the injection process (Section 4.5.1.6). Section 4.5.1.8 also describes the monitoring efforts that would be used to ensure that injection pressure are maintained within approved limits.

U140 We have added the appropriate references to Section 4.5.1.7.

U141 These mitigation/monitoring measures are either part of ongoing programs, have recently been implemented, or are to be implemented as an outcome of this EIS.

U142 This information is available from the EPA, because disposal of produced water is permitted on a well-by-well basis under the EPA's Underground Injection Control program. Each injection well must have specific reservoir-engineering studies conducted, and rigorous well tests performed, to validate the operational parameters of injection rates, pressures, and operational life of the well. We are unaware of any issues associated with the injection wells in the Study Area, therefore analysis of reservoir-engineering studies is not required in this EIS.

U143 Given the rapid groundwater responses observed on SUIT land associated with the onset of CBM development, it is likely that Fruitland hydrology would be reestablished to pre-development conditions. Reestablishing pre-development conditions, however, is likely to take more than 200 years. Recharge of the coalbeds requires a fairly small volume of water, because the coal porosity is about 1%.

U144 Any such quantification would be inappropriate speculation, but sedimentation and contamination will be minimized by the use of Best Management Practices (BMPs). Impacts of sedimentation and contamination on rivers and streams should not be significant if BMPs are used.

U145 The cumulative impact of water depletions is presented in Section 4.13.3.4, as well as the overall direct and indirect effects of CBM development on surface water in Sections 4.5.2.3 through 4.5.2.6. Site-specific, localized impacts cannot be assessed on a well-by-well basis, because the water source for each well is unknown at this time. Water sources needed for well construction are identified in conjunction-specific project proposals and associated water issues analyzed in site-specific environmental analyses at the same time.

U146 The evaporation pits dispose of produced water, which contains some entrained methane (approximately 1.0 to 2.0 mg/l). As noted in the DEIS, about 5% of produced water is disposed through permitted evaporation ponds. This amounts to about 5,100 barrels per day. Assuming the entrained methane volatilizes from the water when the water is placed in the pond, about 1.7 to 3.6 pounds of methane/day are discharged to the atmosphere. This is equivalent to 40 to 80 standard cubic feet of methane per day.

Methane is degraded in the atmosphere by ultraviolet light, eventually broken down into water and carbon dioxide.

Minerals dissolved in the water are not volatilized. They remain in the pond, and the precipitated solids are disposed of according to the terms of the permit.

U147 These amounts cannot be quantified. Use of Best Management Practices addresses erosion, sedimentation, and contamination concerns in a highly effective manner, minimizing these potential environmental consequences.

U148 No pollutants are discharged to the surface water system from the drilling phase or production phase at the well. Produced water is not discharged to surface water, nor are any drilling fluids.

U149 Section 4.5 includes a detailed analysis of impacts on surface water. The greatest potential for such impacts is from construction of roads, pipelines, and well pads that change surface-flow dynamics, causing channelization and increased erosion. Implementation of the mitigation and Best Management Practices described in the EIS for the control or containment of surface-water runoff during construction and abandonment activities is predicted to reduce surface-water-quality impacts to an insignificant level.

U150 Operations in the San Juan Basin are not analogous to the Black Warrior Basin in Alabama or the Powder River Basin in Wyoming. Any comparisons between these CBM operations and surface-water impacts that may occur from San Juan Basin operations are not valid.

U151 There's no relationship between illegal activities and an increase in well densities. The various gas regulatory agencies, BLM, BIA, EPA, SUIT, and the State all monitor gas development and production carefully. Violations, should they occur, would be dealt with appropriately.

U152 The results of BLM reports, as well as published studies like the 3M project, are incorporated in the Biological Assessment and throughout the text of the EIS. A more rigorous study is underway to address CBM development in areas north of the SUIT reservation. Studies to date show hydrologic relationships between CBM development and area rivers, although any related impacts are not predicted to be significant. Section 4.5.2.7 states:

> Extended over the 20-year period covered by this EIS, the expected annual maximum water use requirement for well construction and stimulation associated with Alternative 2 is 25 acre-feet/year (Table 4-23). The expected annual maximum water use requirement for Alternative 3 is 27 acre-feet/year. The water use requirement for Alternative 1 would be less, approximately 18 acre-feet/year. Because water for drilling and stimulation would be acquired from existing irrigation sources, although it is possible that some water may be acquired from

local streams, ponds and formations, significant well construction related water depletion impacts are not anticipated.

Additionally, the 3M Study estimates that CBM gas production within the Study Area will intercept approximately 37 acre-feet of Fruitland Formation water that would normally discharge into the Animas River. This amount of water is not presently measurable in-stream and is not anticipated to significantly impact fish habitat or agricultural use.

For comparison purposes, the average annual runoff in the Animas River near Cedar Hill, New Mexico (2.5 miles upstream from the Colorado-New Mexico state line) for period 1934 to 1996 was 671,700 acre-feet (USGS 1996). The 3M (Monitoring, Mapping, and Mitigation) project will continue to monitor the situation and report to the participating agencies, the public, and the Fish and Wildlife Service any changes, particularly increases, in the calculated depletion.

Section 4.13.3.4 states:

No significant cumulative impact on water resources is expected as a result of past and projected oil and gas development on the Reservation. Future development of oil and gas resources, both within the Study Area and elsewhere in the San Juan Basin of Colorado, would utilize produced water and fresh water obtained by permit or commercially. The total volume of fresh water needed for all oil and gas development in the Colorado portion of the San Juan Basin is estimated to be approximately 81 acre-feet per year, or three times the 27 acre-feet per year needed for the Agency-and-Tribal-Preferred Alternative. Additionally, approximately 155 to 200 acre-feet per year of instream flow will be lost to the riverine system due to interception of Fruitland Formation recharge into the Pine, Florida, Piedra, and Animas Rivers by producing CBM wells along the Fruitland outcrop north of the Study Area and in the Indian Creek area. Thus, the amount of water that would be consumed through construction or lost through depletion would total approximately 280 acre feet per year over the life of the field.

U153 Please see the responses to Comments U-148, U-149, and U-152.

U154 Best Management Practices include routing access roads to minimize erosion, containing all drilling fluids at the well site, disposal of saline produced water into deep formations and lined evaporation ponds, revegetating disturbed soils, and constructing crossings (pipeline and road) according to current regulations in a manner that minimizes stream channel disturbance.

U155 Entrained-methane concentrations in groundwater in those areas potentially affected by incompletely cemented gas wells appear to be decreasing following gas well remediation efforts,

according to the 1998 study on domestic wells in proximity to remediated gas wells.

U156 Ground water depletions associated with CBM production are restricted to the Fruitland and Pictured Cliffs Sandstone. These formations are hydraulically separated (confined) from the overlying Animas, Nacimiento, San Jose, and Ojo Alamo Formations, which are the primary drinking water aquifers within the San Juan Basin. The Kirtland Shale that overlies the Fruitland Formation and underlies the shallower drinking water aquifers contains nearly 1,000 feet of impermeable strata that effectively separates the Fruitland Formation from the shallower aquifers. The only ground water depletion impacts on domestic water supplies are limited to those few wells that are located immediately on the Fruitland and Pictured Cliffs Sandstone outcrop areas, as described throughout the EIS.

There are no ground water depletions from development of conventional oil and gas reservoirs in the Study Area. This is because the conventional oil and gas reservoirs are deeper and hydraulically separated from the domestic water supply aquifers by several thousand feet of impermeable shales, mudstones, and other impermeable strata.

U157 The Pictured Cliffs Formation is a source of water for CBM wells and adds to the overall amount of produced water in some wells.

U158 We respectfully disagree. *Direct* impacts on land use resulting from the proposed Alternatives are related primarily to physical restrictions and loss of agriculture, livestock grazing, timber production, wildlife habitat, and recreational areas. Visual impacts and depreciation of land value also could also directly affect surface owners. *Indirect* impacts consist of activities that impinge on existing uses, such as dust and noise from traffic that may affect residential areas, and water contamination that could affect existing agricultural or residential uses. Impacts resulting from each of these activities are presented in Sections 4.2, 4.5, 4.6, 4.7, and 4.11.

Section 4.6 describes and quantifies the range of direct and indirect impacts that could result from the proposed activities, including (1) loss of land or land value, including potential agricultural, rangeland, and forest production; (2) displacement of recreational land; (3) effects on applicable regional plans, adopted policies, goals, or operations of communities or government agencies; and (4) land-use incompatibility with residential, recreational, commercial, and government/public areas.

U159 Potential changes of the rural quality of life in the Study Area are well documented throughout the EIS, and are primarily related to aural and visual impacts. Given the tribe's commitment to mitigating impacts on these resources, and because oil and gas development would take place primarily on tribal land that is not available for rural residential development, only slight changes are predicted in the rural quality of life in the Study Area.

U160 Section 4.6.9 (Unavoidable Adverse Impacts) states:

> Unavoidable adverse effects include long-term impacts on existing agricultural, grazing, and timber resource lands resulting from the long-term removal of land from these uses for CBM and conventional well facilities, including access roads. Unavoidable short-term impacts would include dust, noise, traffic, and visual effects from facility construction and operations on existing residential and recreational areas. The industrial character of project facilities and activities would slightly change the rural quality of life currently afforded in rural residential areas, including impacts on residences which are located on non-Indian lands within the exterior boundaries of the Reservation.

U161 A La Plata County study is underway to determine the cumulative effect on real estate prices of oil and gas development. The study is not complete and there are no preliminary conclusions to share now.

Section 3.10, however, presents information that shows how real estate values in La Plata County continue to increase, with almost no exceptions. For example, the number of residential properties assessed in La Plata County grew from 12,769 in 1990 to 15,833 in 1996, an increase of 23 percent over 6 years. The assessed value of those nonvacant residential properties increased by nearly 50 percent, from $126.4 million to over $189.1 million.

U162 Please see Comment Response U161.

U163 We believe that Sections 3.6, 3.10, 4.6, and 4.10 use accepted methods to quantify and disclose the direct and indirect economic and physical impacts on various categories of land in the Study Area. The conclusion of these analyses is that increased well densities are economic.

U164 Please refer to Sections 3.6, 3.10, 4.6 and 4.10.

U165 No impacts resulting from implementation of the Alternatives (Table 4-34) are predicted to occur in designated recreation areas.

U166 Most of the land in the Study Area is either privately or tribally owned, and is not available for visitor recreation. Therefore the impacts of any of the Alternatives on visitor recreation and tourism are predicted to be minor, as described in Section 4.13, Cumulative Impact Assessment.

U167 In general, only tribal members can hunt and fish in the Study Area. Section 4.3.2 describes impacts on hunting and fishing.

U168 Although the proposed Alternative would result in an increase in traffic volume of about two to six percent above naturally occurring background volumes, there is no indication that this would lead to a heavy concentration in the town of Ignacio, or any measurable change from current gas-industry-related traffic levels, which are two to six percent of current traffic levels (Section 4.7). Most of the activity associated with each of the Alternatives would occur west of Ignacio; most of the traffic would be between Farmington, NM, and the SUIT Reservation, and on Reservation roads.

U169 Bridges that may not accommodate overweight drilling units are CR 105 and CR 122 over the La Plata River in the west, and two bridges on CR 334 over Allison Ditch in the east (Section 3.7.1). The weight of trucks hauling drilling rigs varies, depending on the type of rig and number of axles, but does not exceed 120-130,000 pounds; this weight is distributed across the length of the hauling unit.

Overweight units require permits from the CDOT that outline the appropriate route to take, in order to avoid bridges that cannot accommodate the weight of the unit. The tribe stipulates that operators and contractors abide by these permits. Additionally, rig movement associated with the preferred Alternative does not involve any of the above-mentioned bridges: the first two are outside the development area, and the last two have several alternate routes nearby.

U170 CDOT and the La Plata County Road and Bridge Department are responsible for road maintenance. We assume that the funds collected for registration fees, oversize/overweight permits, and fuel use taxes are sufficient to cover these costs. With OS/OW permits costing $400-800 annually per vehicle, fuel tax at 20 cents/gallon, and registration fees of $2,300 per year per vehicle, owners and operators of vehicles required to pay these fees are contributing thousands of dollars annually to public-roadway maintenance budgets.

U171 Maximum potential air quality impacts of fugitive-dust emissions from vehicle use on unpaved roads during the 36-day construction period at each well location (based on a "reasonable, but conservative" assumption that up to four well sites could be developed concurrently within one-half mile of each other) were reported in the DEIS (pages 4-9 through 4-10; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery). These construction-related impacts would not be significant. Other cumulative fugitive-dust impacts (e.g., during operation) would be less.

U172 The DEIS analyzed the potential direct and cumulative air quality impacts from a number of construction and operation air pollutant emission sources (including fugitive dust) and

determined there would be no significant air quality impacts. To the extent that existing fugitive-dust impacts are represented by the background concentration values reported in Chapter 3 (Affected Environment), they were included in the air quality impact assessment. Please also see Comment Response U117.

The environmental impact analysis process required under NEPA is to “be analytic rather than encyclopedic” (40 CFR 1502.2(a)). No survey of “studies that have gauged and quantified fugitive dust impacts on date” was performed. The Respondents should contact the applicable air quality regulatory agency directly if they believe current air quality impacts from fugitive dust are violating applicable air quality standards.

U173 As reported in Table 3-1 of the DEIS (page 3-6; Measured Concentrations of Regulated Air Pollutants at the SUIT Monitoring Station near Ignacio (in $\mu g/m^3$)), background PM_{10} measurements have all been well below applicable Ambient Air Quality Standards. Without knowing the size distribution of the sampled particulate matter, no conclusions can be reached regarding the new $PM_{2.5}$ Ambient Air Quality Standards. Since the Study Area is classified “attainment” or “unclassifiable” for all criteria pollutants (including particulate matter), EPA and the CDPHE-APCD apparently agree that fugitive-dust impacts are below applicable Ambient Air Quality Standards. In addition, based on EPA’s “rural fugitive dust policy,” air quality regulatory agencies are not required to implement control strategies for windblown dust or agricultural activities within “attainment” or “unclassifiable” areas.

Please also see Comment Response U172.

U174 Most accidents occur where the roadway causes vehicles to interact in conflicting movements, such as a lane merge or intersection. An increase in the accident rate would be expected if the number of such locations were expected to increase (Section 4.7.2.3). Since none of the Alternatives involve the construction of new public roadways or require any new intersections, traffic accident rates are not expected to increase under any of the three Alternatives.

U175 Impacts on archaeological sites, whether eligible or not, are predicted to be insignificant because of the tribe’s commitment and proven ability to avoid impacts on cultural resources, by using site-specific project planning.

U176 The Southern Ute Tribe’s cultural-resource policy has always been avoidance of any archaeological sites. Additional mitigation has rarely been necessary. Please also see Comment Response U49.

U177 We believe the Study Area-specific methodology used accepted techniques to analyze

visual impacts of the three Alternatives reasonably and accurately.

U178 Please refer to Tables 4-44, 4-45, and 4-46 for a comparative analysis of visual impacts on residential areas of each of the Alternatives.

U179 Flares are usually lit in conjunction with well completion and testing, as discussed in Chapter 2. The text in Chapter 2 under the subheading Flaring and Testing has been rewritten to clarify the circumstances under which flaring occurs.

The impacts of flaring on residents and viewsheds have not been quantitatively studied, so no data are available on this subject. The direct impact of flaring on nearby residents and viewsheds is primarily the addition of a flare (flame) to the field of view. The impact of the flame on a viewer depends on many variables, such as the gas-production rate and content, the wind speed and direction, the existence of visual barriers, the visual surroundings, the proximity of the viewer to the flare, and the intensity of daylight or moonlight. Most wells are flared only when a cavitation completion is in progress.

Because of the isolated and short-term nature of flaring activities, any associated direct and cumulative impacts are predicted to be insignificant.

U180 Please see the response to comment U166.

U181 43 CFR 3162.3-4 requires that a well which is incapable of production in paying quantities be promptly plugged and abandoned, in accordance with the approved surface operating plan. Therefore visual impacts will remain until reclamation, including revegetation, is completed after abandonment pressures are reached. The revegetation time will vary according to the environmental setting: a sagebrush or grassy area can revegetate completely in one growing season. Disturbances of heavily wooded areas will take longer to revegetate, but visual impacts in such areas can be substantially unnoticeable in 10 to 20 years after reclamation is completed.

U182 Please refer to Section 4.13.3.8 for the presentation of cumulative visual impacts. Federal andStatevisual resource management standards and/or objectives do not apply to tribal land. The comprehensive mitigation presented in Section 4.9.8, however is designed to minimize the visual impacts of CBM development in the Study Area.

U183 No impacts are predicted in the referenced land-use categories. There are no Federally designated recreation land-use categories on tribal land, nor are there requirements or methodologies to analyze visual impacts on any such land outside the Study Area.

U184 Evaluations of health, safety, welfare, and environmental impacts are in specific subsections of Chapter 4. Health and safety are evaluated in 4.13. The welfare of the Southern Ute Indian Tribe and its members is evaluated in terms of cultural benefits, financial benefits (such as jobs), and social services. The welfare of other population subgroups is considered in terms of financial impacts of increased jobs and services provided by taxing authorities. The environmental impacts for which substantive data were available for disclosure and evaluation are addressed under specific resources (e.g., groundwater, soil, air quality) in Chapter 4.

Economic evaluation of production was carried out to quantify the potential financial benefits to the Southern Ute Indian Tribe and to County and State collections/programs, via taxes. There is no requirement that production of tribal resources be carried out economically or in the interest of the general (nontribal) public, so long as it conforms to applicable Federal statutes. The Federal government's trust responsibility to a tribe requires that the BIA and BLM assist the tribe in developing resources in the its best interest.

U185 The prices used were reasonable when the analysis was done. The calculations were conservative in estimating the potential benefits of development, and therefore are still valid. If prices remain higher than modeled throughout the life of the project, then the economic benefits to all parties could be higher, while any potential negative impacts would be unaffected by price fluctuations. Higher prices could be partially offset, however, by higher costs or by production delays due to competition of this area with other oil and gas producing areas for capital, labor, and equipment.

U186 a i): No substantial negative impact on social services is expected. As described in Chapter 4, development of tribal land would be most evidenced by increased prosperity of the tribe, resulting in positive social and cultural effects and less need for social services such as crime control, welfare, and counseling. Most of the infillable tribal land is not close to nontribal homeowners.

U186 a ii) There is no study to date regarding the impacts of development of tribal gas resources on real estate. Because housing on the Southern Ute Reservation is concentrated around Ignacio, it is unlikely that development of tribal resources would significantly impact real estate prices.

U187 b i) The infill and ECBM programs described in Alternatives 2 and 3 are intended primarily to add additional recoverable resources, not to accelerate development.

U187 b ii) CBM development on the land affected by the development should increase personal property tax collections (taxes on equipment on locations), as well as taxes on gas produced. Both types of taxes are collected on property owned by nontribal companies. There is no development on tribal land along the outcrop, so there would not be any impact on taxes from

this land.

U188 Section 4.11 presents a thorough analysis of potential noise impacts from the three Alternatives analyzed in the EIS, as well as numerous noise mitigation measures.

U189-U192 It is impossible to estimate these expected numbers, since there are no sources of relevant industry data available. A historical review of local papers, including the *Durango Herald*, *Farmington Daily Times*, and the *Four Corners Business Journal*, did not reveal any incidences involving CBM gathering lines, but one incident involving construction on another operator's well site did end in a fatality. Tribal CBM operations include daily well-site safety meetings, and stringent safety standards are strictly adhered to, making them as safe as other construction-related operations. If an explosion should occur, the gas supply to the area would be terminated, which would help confine it to a small area. Furthermore, most of the development within the Study Area would be in areas of low population density, lowering the probability of human injury in the unlikely event of an incident.

Several methods are used to protect pipelines from the most likely causes of failure, including:

- Cathodic protection systems,
- Leak detection systems,
- Line surveys, and
- Inspection and testing of valves and overpressure devices.

According to Mike Boland of Red Cedar Gathering Company, one hundred percent of Red Cedar's pipelines are cathodically protected through an impressed-current system.

The Office of Pipeline Safety (OPS) works with the oil and natural gas pipeline industries to improve safety and environmental protection in cost-effective ways. Currently, the primary regulatory basis for achieving these safety goals is the set of regulations embodied in Title 49 of the Code of Federal Regulations Parts 190-199 (Oct. 1, 2000). The Federal pipeline safety regulations: (1) ensure safety in design, construction, inspection, testing, operation, and maintenance of natural gas and hazardous-liquid pipeline facilities, and in the siting, construction, operation, and maintenance of LNG facilities; (2) set parameters for administering the pipeline safety program; (3) require pipeline operators to implement and maintain anti-drug and alcohol-misuse prevention programs for employees who perform safety-sensitive functions; and (4) delineate requirements for onshore oil pipeline response plans.

The regulations are written as minimum performance standards, setting the level of safety to be attained and allowing the pipeline operators discretion in achieving that level. In addition, pipeline companies perform many discretionary activities over and above the regulations to achieve these goals.

TO: Don Englishman, Minerals Supervisor
Bureau of Land Management
San Juan Field Office
15 Burnett Court
Durango, CO 81301
970-385-1346

RECEIVED
Signed: RD Estelle
Date: 3/27/01

From: Carl Weston
3905 Hiway 550
Durango, CO 81303
970-247-9594
E-Mail crweston@mindspring.com

Subject: Public Comment
Oil And Gas Development
On The Southern Ute Indian Reservation
Environmental Impact Statement

I have resided and owned property within the Southern Ute Reservation boundaries for 33 years at SW 1/4, SW 1/4, SECT 31, T33N, 9W.

My comments on this EIS are inadequate and severely circumscribed because of the limited time allowed to study such a voluminous document that took six years to compile. Full semester college courses use smaller texts than this EIS. Technical jargon has no ordinary explanation that would provide the average citizen with an education level of high school plus two years, with an understanding of the impact being described. For example, "Maximum direct CO impacts during operation were predicted to be nearly 159 ug/m^3 (1 hour) and 110 ug/m^3 (8 hour)". Now what the hell are the health effects of living next door and down wind to that? with a pre-existing cardiac condition? during weather inversion conditions? V-1

At a minimum, an additional month is requested to study this tome. V-2

One of my stronger concerns is for the cumulative and synergistic impacts of localized air pollution under the least favorable meteorological conditions, especially in confined watershed topography. EPA has said that there are no monitoring facilities on the S.U Reservation that would measure those conditions. There is little point in comparing three alternatives, none of which can determine the localized (health) impacts on contiguous neighbors. Human respiration is a continuous vital process. It cannot be intermittent with a minimum number of adequate hours or days, like a tourist's view of the scenery. V-3

The lack of adequate localized monitoring facilities raises the issue of where and how non-Indian residents of the Reservation can effectively seek remedial action of unsatisfactory or non V-4

compliant air quality impacts. Where in this EIS is this level of mitigation addressed? It would appear to belong in the environmental justice section. V-4 (cont)

This EIS continually and extensively uses the term "ambient" to describe air quality standards without defining how uniform the air quality is within the area to which the term applies, or whether the "ambient" air quality can be statistically manipulated by including or excluding topography with greater or lesser levels of pollution. It would appear that the lower terrain of watershed courses should be specific separate "ambient" measurement areas, particularly since most of these areas are where residential development is concentrated. It also appears to be the preferred area for location of compressor stations. It is the area where inversion weather conditions most concentrate air pollution, especially at night. V-5

Adjusting residential exposure levels for "time away from home" is disingenuous sophistry. Elderly and pollution vulnerable residents are those most likely to be continuously confined at home. Human beings cannot be quantitatively or qualitatively measured as some statistical aggregate organic mixture like algae. They are as vulnerable to pollution impacts as the weakest, and most impaired, single individual, for the shortest period of time necessary to negatively impact human physiology at any age or stage of human existence, from unborn or newborn to frail elderly. Estimates of pollution impacts should be addressed using that standard. V-6

Wetland mitigation should have wetland avoidance as the first and highest priority. Wetlands created by produced or diverted water should not be eligible as "replacement" mitigation unless the sustaining water source can be legally and physically assured in perpetuity. V-7

There are a number of issues cited as " not been mapped", "not been formally studied", "difficult to quantify", etc.. These issues should be collated and categorized so the public can see and evaluate where the greatest number of unknown, ignored and unexamined issues lie. V-8

To be continued (contingent on extended comment deadline) V-9

ADDENDUM to COMMENTS 3-27-01

Access road construction, 2.8.4.1 explains why there is such a destructive sediment load entering the Animas River in side drainages from the west on the S. Ute Reservation. EPA has updated both point and non-point source water quality requirements (storm drainage) for construction sites since the 1978 manual cited in this section. Where, when, and how is the Storm Water Pollution Prevention Plan required by EPA under V-10

Sect. 402 of the Clean Water Act incorporated into routine access road construction, and maintenance? Logically it should be a routine part of the EA prerequisites for APD approval. Construction activities are addressed in E-1 Common Mitigation Measures limiting them to dry conditions but maintenance activities are not. Where access roads come to be used for additional wells and/or other ancillary equipment, modifications caused by access road maintenance and wet weather damage, i.e. rutting by heavy vehicles, should have compliance monitoring that is spelled out in the SWPP and a BLM or Tribal process for enforcing it. To date, construction plans appear to lack any engineering modification contingencies for worst case seasonal weather conditions or for year round wet weather use by heavy equipment vehicles. Heavy depositing of mud on the nearest all-weather public roads because of access road construction and maintenance deficiencies is apparently not addressed, despite the mud and siltation damage to public road surfaces, culverts, and ditches, and resulting migration of sediment into stream courses. Such heavy mud displacement also often carries a big load of noxious weed seeds and plants. Heavy trucks often use chains to negotiate these deficient access roads. They then drive on public roads with the chains on, damaging the surface while looking for a convenient place to remove the chains and dump the mud load on the public road surface. The heavy construction equipment for building these access roads is frequently unloaded on the nearest piece of dry, level public road. This does more damage to public roads than the total regular use by heavy vehicles.

V-10 (cont)

V-11

V-12

2.8.3.7 APD approval- The concurrence letter from B.I.A. to address U.S.F.W.S. consultation requirements appears grossly inadequate to assure that U.S.F.W.S. survey and consultation requirements are up to date, timely and seasonally relevant, and complete. This appears to be a huge opportunity to "pass the buck" among agencies without guaranteeing compliance.

Cavitation activity impacts have been appended to this EIS as an apparent after-thought. Does this mean that all of these impacts will be addressed in all future cavitation operations, whether conducted as an initial drilling operation , or as a subsequent production stimulation procedure? Since I initially raised these issues, There are still unresolved issues. The cavitation process appears to be evolving. Water injection of 1000 bbls. or more has been incorporated into the process. This would seem to result in less complete incineration of coal fines but the flaring process still occurs. What temperature ranges are these coal fines exposed to? How much heat does it take to release tars, volatile compounds, etc. from coal fines. Does such "cooked" coal and/or "cooking" residue continue to disintegrate when buried on site, often without regard to the depth of the surface water table? Heavy metal pollutants were "expected to fall out within the 2.88 acre well location", then what? What happens with dust containment watering? What happens if there is a heavy rainfall ? What happens if a heavy snowfall is plowed

V-13

off the well pad into the nearest storm drainage course? Are "cooked" coal fines on surrounding foliage totally benign? when ashed off with water? Recent cavitation activity near Bondad has revealed that the process does NOT have to be conducted at night. Will this change in procedure become a required mitigation of impacts on nearby residences? How will required mitigation be enforced on subsequent cavitations not associated with the initial drilling APD or where the original APD was silent on the cavitation process? V-13 (cont)

These comments are concluded under protest because of insufficient time to study the EIS in depth. V-14

Carl Weston 3/24/01

Responses to Comment V from Carl Weston, Individual

V1 Please see our response to Comment S-1.

V2 Please see Comment Responses E1 and S2. Also, the Respondent was granted and verbally agreed (on 3/21/01) to a 10-day extension, which provided a total of 85 days to comment on the DEIS.

V3 Please see our response to Comment S-3.

V4 Please see our response to Comment S-4.

V5 Please see our response to Comment S-5.

V6 Please see our response to Comment S-6.

V7 Please see response S-7. Mitigation primarily involves total avoidance of wetlands (Section 4.3.1.8). Produced water is disposed of through injection wells and evaporation ponds and is not available for wetland creation, due to high levels of total dissolved solids.

V8 Please see Comment Response S8.

V9 Please see Comment Response V2.

V10 Under 40 CFR 122, the EPA requires operators to prepare stormwater management plans for prevention of discharges from any facilities disturbing more than 5 acres. Compliance with these plans is required of the operators by the EPA.

V11 We agree, weed seed can be dispersed by wildlife, livestock, wind, and vehicles using county and reservation roads. The tribe and BIA are committed to an aggressive program of weed control.

V12 While some operators may carry out these practices, it is the intention of the tribe to ensure that all operators and contractors operate in a manner that minimizes wear and tear on public

roads. This includes removing chains and unloading equipment on access roads, rather than on public roads. This is not always possible, but all attempts are made to do so.

V13 We expect no significant air quality impacts at those limited well locations where cavitation (air and/or water injection surging cycles, followed by flaring of the produced gas and coal fines) is employed over a 10- to 15-day period during well completion and testing.

Although the DEIS examined potential air quality impacts during an assumed 36-day well construction period (3-day well pad and resource road construction; 8-day rig up, drill, and rig down; and 25-day well completion and testing), the DEIS did not specifically assess potential air quality impacts from optional cavitation procedures. The description of the potential air quality impacts of a similar cavitation operation was included in Appendix O of the DEIS. *(Note: The information presented in Appendix O in the DEIS has been incorporated into the text of the FEIS, in Sections 2.8, 3.2 and 4.2. Appendix O now contains oil and gas well spacing order information for the FEIS.)*

The quantity of air pollutants released during a total 60-hour cavitation flaring period (distributed over 10 to 15 days; assuming 1 to 2 hours flaring for each of 20 to 30 cavitation cycles) may be assumed to be less than the 168-hour total testing flaring period (distributed over 7 days), as analyzed in the DEIS. The potential emissions of inhalable particulate matter (PM_{10}) from the total testing flaring represent only 0.2 percent of the total potential PM_{10} emissions during the entire 36-day well-construction period. Emissions of other pollutants due to flaring are minimal when compared to the applicable Ambient Air Quality Standards.

Even if all potential construction PM_{10} impacts reported in the DEIS included the same distribution of toxic air pollutants reported in Appendix O of the DEIS for coal fines (an absurdly conservative assumption), potential metal concentrations would be well below safe thresholds reported by the EPA, the American Conference of Governmental Industrial Hygienists (ACGIH), and the Toxicology Excellence for Risk Management (TERA) nonprofit organization, per the following table.

Metal	Maximum Total PM_{10} Concentration ($\mu g/m^3$) 1/	Coal Fines Metal Proportions (ppm) 2/	Maximum Metal Concentration ($\mu g/m^3$)	EPA Standard ($\mu g/m^3$) 3/	ACGIH Threshold Limit Value ($\mu g/m^3$) 3/	TERA "Safe" Concentration Value ($\mu g/m^3$) 4/
Barium	77.4	160	0.124	n/a	n/a	1.2
Copper	77.4	14	0.011	n/a	n/a	2.4
Lead	77.4	12	0.009	1.5	n/a	1.5
Manganese	77.4	23	0.018	n/a	50	0.05
Mercury	77.4	<1 [Trace]	<0.001	n/a	100	n/a
Nickel	77.4	3	0.002	n/a	100	0.2
Selenium	77.4	1.8	0.001	n/a	200	0.5

Sources:

[1/] Oil and Gas Development on the Southern Ute Indian Reservation DEIS; CHAPTER 4 - ENVIRONMENTAL CONSEQUENCES; AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery; October 2000. Total predicted PM_{10} 24-hour concentration of 127.6 $\mu g/m^3$ minus maximum observed background concentration of 50.2 $\mu g/m^3$ yields a maximum direct modeled impact of 77.4 $\mu g/m^3$.

[2/] Oil and Gas Development on the Southern Ute Indian Reservation DEIS; Appendix O; June 2000 Addendum; Environmental Assessment for the Payee #221 Natural Gas Well Site Project by Coleman Oil and Gas, Inc (NM-070-97-3222).

[3/] U.S. Environmental Protection Agency; Health Effects Notebook for Hazardous Air Pollutants (www.epa.gov/ttn/atw/hapindex.html).

[4/] Toxicology Excellence for Risk Management (TERA); Utility Emissions and the Toxic Release Inventory; Cincinnati, OH; August 1999 (tera.org/news/cinergy%20report%20in%20adobe.pdf); TERA "safe" concentrations are the applicable Threshold Limit Values adjusted for nonoccupational exposure by dividing by an uncertainty factor of 420, accounting for sensitive individuals and continuous exposure.

Notes:

1) Lead is the only metal for which the EPA has established a National Ambient Air Quality Standard; the EPA has not classified barium or copper compounds as Hazardous Air Pollutants.

2) As clearly stated in the DEIS, "Given these numerous 'reasonable, but conservative' analysis assumptions, which actually may compound one another, the predicted impacts represent an upper estimate of potential air quality impacts which are unlikely to actually be reached" and "the scientific evidence is not compelling that reasonably foreseeable significant adverse impacts would occur."

V14 Please see Comment Response V2.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
999 18TH STREET - SUITE 300
DENVER, CO 80202-2466
http://www.epa.gov/region08

April 2, 2001

REF: EPR-EP

Bureau of Land Management
San Juan Field Office
Attn: Donald Englishman
15 Burnett Court
Durango, Colorado 81310

RE: Comments for the Draft Environmental Impact Statement for Oil and Gas Development on the Southern Ute Indian Reservation (CEQ #010015)

Dear Mr. Englishman:

In accordance with our responsibilities under the National Environmental Policy Act (NEPA), 42 U.S.C. Section 4321, et seq., and Section 309 of the Clean Air Act, the Region 8 office of the Environmental Protection Agency (EPA) has reviewed the referenced Oil and Gas Development Draft Environmental Impact Statement (DEIS) for the Southern Ute Indian Tribe (SUIT). This letter transmits our rating on the preferred alternative.

Since we received the additional documents that we requested, we have completed our review of the DEIS. The attached comments identify six major issues that we have with the document. There are many missed opportunities for mitigation that would dramatically reduce impacts to environmental resources such as wetlands and threatened and endangered species. In addition, the DEIS did not thoroughly analyze the possible impacts that could result from methane migration. The range of alternatives could be easily expanded by incorporating different mitigation possibilities to reduce environmental impacts. The cumulative impacts analysis did not include past impacts to wetlands and threatened and endangered species.

We would like to recognize BLM for the work on the air analysis section of the DEIS and the Air Quality Technical Support Document. We appreciate BLM's responses to our requests for additional information and analysis for the impacts analysis.

COMMENT W

Summary of Alternatives

- Alternative 1 is the no action alternative. The no action development would continue to allow activity to complete the oil and gas development based on 1 well per 320 acre unit.

- Alternative 2 proposes to change the well spacing within the study area from 1 well per 320 acre unit to 2 wells per 320 acre unit. Since the study area has nearly developed the entire project area for 1 well per 320 acres, this alternative would effectively double the number of wells.

- Alternative 3 includes the well spacing change of alternative 2 and also incorporates the proposal for the enhanced recovery of coal-bed methane. This is identified as the Preferred Alternative in the DEIS.

Review and Rating of the Preferred Alternative

It is EPA policy to provide a general rating specifically on the Preferred Alternative and individually rate all alternatives if necessary. The Preferred Alternative or Alternative 3 receives a rating of **EO-2** (environmental objections, insufficient information). A full description of EPA's EIS rating system is enclosed.

The rating of EO results from unacceptable projected impacts to 171 acres of wetlands; the possible threats to federally threatened and endangered species (TES) including protection to bald eagle active nesting areas from temporary drilling and construction in addition to routine well service activity. Our EO rating could easily be addressed if mitigation requirements identified in our attached comments and the Biological Assessment were required in the final EIS and Record of Decision (ROD).

Our rating of 2 for insufficient information is due to lack of additional information that would help identify cumulative impacts to wetlands and TES. The significance of losing an additional 171 acres of wetlands without knowing how many acres have been previously lost due to oil and gas development will not be fully understood until the full cumulative impact has been identified. The DEIS points out that inventory information for federal and state TES in addition to SUIT species of concern has not been collected.

Two important reasons for preparing a programmatic EIS are to identify, before development takes place, likely environmental impacts to different resources and develop the appropriate general standard mitigation measures to reduce those impacts. The DEIS is very comprehensive in providing information on anticipated impacts. However, it misses many opportunities to recommend or require mitigation procedures that would reduce environmental impacts.

Page 4-6 of the document describes two distinct types of mitigation that can be discussed in a programmatic DEIS. The first type is a site specific requirement that may only be appropriately applied at the Application Permit to Drill (APD) level such as a specific drilling

pad location requirements. The second type of mitigation is a general application that would be implemented to protect a resource. An example of this would be no surface occupancy for a sensitive habitat area that has been identified in the programmatic EIS. Although the DEIS located many existing type one mitigation requirements, many opportunities to identify and require the general mitigation measures were overlooked.

Since we have reviewed and commented on the preliminary draft EIS last summer, many of our comments reflect previous issues. However, we currently have a more complete document including the Biological Assessment and as a result we may now have additional comments that were not identified during our review of the preliminary draft. If you have any questions or concerns regarding the attached comments or the rating, please contact Gregory Oberley of my staff at (303) 312-7043.

Sincerely,

Cynthia Cody, Chief
NEPA Unit
Ecosystems Protection Program

Enclosures

SUIT DEIS Comments
EPA Rating System for DEISs

cc: Jim Rhett, BLM Colorado District Office
Elaine Suriano, EPA-OFA

COMMENTS ON THE SOUTHERN UTE INDIAN TRIBE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR OIL AND GAS DEVELOPMENT

MAJOR ISSUES

Mitigation Opportunities

Two important reasons for preparing a programmatic EIS are to identify, before development takes place, likely environmental impacts to different resources and develop the appropriate general standard mitigation measures to reduce those impacts. The DEIS is very comprehensive in providing information on anticipated impacts. However, the discussions have missed many opportunities to require mitigation procedures that would reduce environmental impacts.

As was stated on page 4-6 under **Mitigation Planning**, there are two types of mitigation that can be discussed in the DEIS. The first type is a site specific requirement that may only be appropriately applied at the Application Permit to Drill (APD) level such as a specific drilling pad location. The second type of mitigation is a general application that would be implemented to protect a resource.

The DEIS heavily relies on site specific standard procedures currently available in different documents that are referenced or available in the appendix for mitigation. The mitigation measures in those documents are generally the first type of mitigation measure and because of that, they are referred to only as possible or suggested measures and are selected when the APD is reviewed and approved.

While it is appropriate to identify the site specific mitigation possibilities, the second type of mitigation measures also need to be discussed and selected during the programmatic EIS process. The programmatic EIS is a great opportunity to outline and require general mitigation measures that will help reduce impacts. For example, programmatic EISs are the perfect venue to determine sensitive TES areas that need protective mitigation such as no surface occupancy requirements or to map out valuable and highly functioning wooded riparian wetlands that are to be avoided. Some of these excellent mitigation measures are suggested in the Biological Assessment found in Appendix G. However, the DEIS does not go on to clearly state if they are to be considered as a required mitigation measure in the programmatic EIS process. W-1

We would prefer to see general mitigation requirements concerning threatened and endangered species and wetlands that are specific to reducing impacts that have not only been identified in the DEIS but that may occur in the future. The language in the DEIS does not provide BLM or SUIT the ability to assure that these resources will W-2

be adequately protected during the proposed future oil and gas development. We request that the final EIS include such general mitigation measures that provide adequate authority to ensure no losses of Federally Threatened and Endangered Species (TES) and wooded riparian wetlands. W-2 (cont)

Wetlands

The DEIS needs to identify the 404 permit process (nation wide or site specific) that will be used by operators to allow construction activities in wetland areas. The projected 171 acres of maximum wetlands loss is considered a significant impact. Although 171 acres is a projected maximum, we have serious concerns about the commitment to avoid impacts to wetlands on a project by project basis. 40 CFR §1508.7 states "Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" Each individual wetland road or pipeline crossing might be considered a minor impact but the cumulative loss of 171 acres identified in the DEIS for the proposed action is significant and would not be considered minor by the US Army Corps of Engineers or by EPA. W-3

Although page 4-40 summarizes possible mitigation measures for reducing wetland impacts, the programmatic EIS needs to provide mitigation measures that will eliminate or significantly reduce impacts to wetlands. The potential loss of 171 acres of wetlands is unacceptable and there needs to be a comprehensive discussion in the DEIS concerning wetland avoidance requirements that will reduce the wetland losses. W-4

BLM has not met the requirements found in 40 CFR §1502.14(f), §1502.16(h), and §1508.14 which declare that the mitigation measures must cover the range of impacts of the proposal. Therefore the DEIS must look at a range of mitigation that would include requirements that would eliminate wetland impacts. The statement on page 4-40 "avoid wetland impacts to the fullest extent without compromising the intent of the project" does not meet the intent of the CEQ regulations or Executive Order 11990. At a minimum, the operator should be required to demonstrate that additional wetland impacts cannot be avoided. W-5

Since oil and gas development is not a new activity within the study area, there should be existing monitoring information from past development that would provide BLM and SUIT with approaches that would reduce wetland impacts. For example roads and pipelines already exist in almost every section within the study area due to 2 wells being present in each section. As a result, roads and utility corridors do not need to be constructed in wetlands to achieve the intent of the project. In addition, newer technologies such as placing pipelines under wetlands by using boring technologies rather than trenching could provide additional impact W-6

reductions as well as providing relief to operators from the 404 permitting process. The discussion could also look at developing temporary road crossings using portable and re-useable bridges to span smaller wetland areas for heavy equipment to access drilling sites. There are a lot of newer technologies available for placing pipelines and utilities to reduce impacts to wetlands. None of these available and widely used technologies were discussed in the DEIS. (cont) W-6

Threatened and Endangered Species

We are especially concerned about potential impacts to federal TES (Threatened and Endangered Species) and the lack of required measures to avoid the loss of species. The DEIS is clear that potential impacts could occur but it is vague as to how BLM, BIA and SUIT will provide the necessary mitigation requirements to avoid loss of habitat or species. The DEIS has identified a number of TES that without general mitigation requirements could be impacted by the proposed future oil and gas development. Similar to the wetland discussion above, there were no general mitigation measures that are required in the DEIS that would prevent TES losses. Section 4.3.3.9 **Mitigation Summary** on page 4-76 does not provide for the general mitigation measures that would be applied to critical habitat areas for federal TES. This section refers the reader to Biological Assessment in Appendix G for mitigation measures for individual federal TES. However, the **Mitigation of Impacts** sections under individual TES in the Biological Assessment do not imply any of these measures would be required. Most programmatic EISs have requirements for no surface occupancy during nesting or for critical habitat and other requirements that would apply to TES species. W-7

Methane Seepage

It is well understood that methane can be produced by decaying organic material in soil and shallow subsurface. To imply in the DEIS that areas of concern for methane seepage in the San Juan Basin is anything but the result of migration from gas production zones is misleading and delays addressing the problem. Methane generation from domestic septic systems are rarely considered to be a problem elsewhere in the country and certainly methane contamination is not the widespread issue that has been identified in the San Juan Basin. Methane seepage resulting from decaying natural organic material in surficial aquifers should not be expected to be a greater problem than is observed in other areas outside the San Juan Basin. W-8

The DEIS does not propose specific methane seepage monitoring even when it has already been determined that impacts exists from prior oil and gas development. Instead the DEIS relies completely on the referenced 3M Study which is being conducted outside the study area. We would suggest that BLM and the SUIT develop and implement an additional monitoring program that will provide site specific information for the study area concerning impacts from methane seepage into drinking water aquifers and seepage into buildings. Outside the reservation boundaries the Colorado Oil and Gas Conservation Commission (COGCC) has required operators to sample nearby drinking water wells in order to determine if drilling and production have impacted the aquifer, or if there was a pre-existing methane seepage problem. Similar procedures need to be implemented on SUIT lands in order to provide landowners with information and the ability to gain access to compensation for impacted sources of drinking water. In many situations where oil and gas production has impacted drinking water wells, the operators are responsible for replacing that resource. The requirements and site specific approval documents that are provided in the DEIS do not address situations when a landowner loses their well to methane seepage. W-8 (cont)

In addition, new monitoring information may provide for adaptive management approaches to methane seepage problem that would address methane migration impacts during the course of the proposed oil and gas development. Coupled with the results and recommendations of the 3M study, new monitoring information needs to be integrated into future oil and gas development requirements. W 9

Range of Alternatives

Section 1502.14 requires the EIS to examine all reasonable alternatives to the proposal. In determining the scope of alternatives to be considered, the emphasis is on what is "reasonable". Reasonable alternatives include those that are practical or feasible from the technical and economic standpoint, using common sense, rather than simply desirable from the standpoint of the applicant.

Although the purpose and need of the document were not well identified in the DEIS, we are assuming these goals are to develop additional gas resources on the SUIT lands in order to provide additional income (Page 2-7, Section 2.3). There are also certain constraints that have been identified within the discussion of the alternatives not selected. SUIT is not considering: development on the eastern portion of the reservation; an 80 acre well spacing; or a moratorium on oil and gas development. W-10

Based on the purpose and need and the constraints, considerable room remains to discuss additional alternatives beyond those identified in the DEIS. Alternatives which are based on additional mitigation of environmental impacts would easily meet the purpose and need of the project and identify a broader range of environmental impacts and mitigation opportunities.

For example the DEIS could discuss an alternative that would provide greater relief of impacts to wetlands and endangered species. Riparian woodlands and critical habitat for TES (including buffer zones) could be identified and construction activity in these areas could be eliminated through locating utility and road corridors outside sensitive habitats. Extracting mineral resources within critical habitat areas could be accomplished through directional drilling from existing well pads and serviced by existing roads and utilities. W-11

Cumulative Impacts

40 CFR Section 1508.7 identifies cumulative impacts to include the incremental impact of the action added to impacts of other past, present and reasonably foreseeable future actions. The DEIS has not included discussion of past impacts for many of the resources on tribal lands such as wetlands, TES, critical wildlife habitat, surface water, vegetation and ground water. W-12

We are very concerned that the DEIS does not identify the amount of wetlands within the study area or the reservation that have already been lost to oil and gas development as well as other construction activities. Without this information it is not possible to determine the true significance of the potential loss of an additional 171 acres of wetlands. W-13

The total surface disturbance of prior oil and gas activities was also left out of the DEIS cumulative impacts discussions. This information is necessary to give a complete picture of vegetation and critical habitat losses. Without past activity impacts it is difficult to determine the cumulative impact of oil and gas development on SUIT lands. W-14

SPECIFIC COMMENTS

(DEIS, Page ES-9, Table ES-1) The table does not include significant wetland impacts that have been identified in the main body of the DEIS. W-14 (cont)

(DEIS, Pages 2-56) The discussion of cavitation is not descriptive enough of the procedure to understand the impacts due to flaring and dispersal of coal fines residue on nearby vegetation and soil. Appendix O has a very good description and should be referenced in this section. The DEIS should also determine if the mitigation measures described in Appendix O, which are required by BLM of operators located in New Mexico, will be required on tribal land. W-15

(DEIS, Pages 2-73, 2-74, 2-75 Section 2.9) The text in this section states "Mitigation and approval conditions for individual APDs will be tiered off the protection measures and mitigation presented in this EIS and modified for site-specific conditions." The DEIS needs to reference what those mitigation and protection measures are that mitigation in APDs will be tiered to for site specific conditions. W-16

In addition, the DEIS needs to be reviewed for the accuracy of the references to other documents. Documents in this section were either missing from the Appendices or do not exist. BLM Onshore Oil and Gas Orders and Notice to Lessees were not provided in Appendix D. In addition, the SUIT General Well Site Conditions of Approval document was not found in Appendix D. It is also understood that the BLM documents listed on page 2-75 do not exist. W-17

(DEIS, Page 3-67 Section 3.5.1.3 **Methane Contamination**) Map 15 referenced in this section does not depict the location of the areas of concern for methane seepage. Please revise Map 15 to distinctly show these areas. W-18

(DEIS, Page 3-68, 3-69) The list of possible vertical pathways for methane migration should also include a statement that identifies that combinations of the listed pathways could occur. This section could also discuss the possibility of hydro-fracturing as a possible source of fractures for vertical migration. EPA is currently conducting a nationwide study to determine if hydraulic fracturing for coal-bed methane production could be contaminating drinking water sources. Serious drinking water contamination problems in Alabama have been associated with hydro-fracturing coal beds in methane production zones. W-19

(DEIS, Page 4-6, Section 4.1.4 **Cumulative Impact Analysis)** This section states that past impacts are important to being able to determine cumulative impacts. Unfortunately, DEIS does not identify past impacts to wetlands and vegetation. It appears that BLM recognizes the importance of this information but did not include it in the DEIS. W-20

(DEIS, Page 4-38, Section 4.3.1.7 **Impacts Summary)** There are no cumulative impacts identified, discussed or analyzed in this section for wetlands, vegetation or noxious weeds. This is very important information that is required in order to be able to determine the full impact of the proposed oil and gas development. W-21

(DEIS, Page 4-39, Section 4.3.1.8 **Mitigation Summary)** For invasive species this section should refer to Section 2 of Executive Order 13112. Wetland mitigation must also incorporate wetland protection measures found in Executive Order 11990 Section 2(a). W-22

Other wetland mitigation efforts that could be incorporated are: temporary bridge crossings for temporary roads, directional boring, and completely avoiding highly functioning wooded riparian areas. Re-fueling, maintenance, and storage areas should also include berms and liners to protect against spills contaminating soil that will be eventually washed into streams no matter what the distance is from the waterway. W-23

(DEIS, Page 4-58, Section 4.3.2.8 **Mitigation Summary)** Activity in wooded riparian areas should be avoided. Programmatic mitigation measures should provide protection for these valuable habitat areas to insure no loss of TES. W-24

(DEIS, Page 4-64, Section 4.3.3.4 **Potential Impacts Specific to TES Species**) The southwestern willow flycatcher is not discussed in the section under federally listed species. The DEIS should not solely rely on percentage of lost habitat area when evaluating impacts to this species. Information on the minimum patch size of wooded riparian habitat for this species may be more important to determine the true impacts of additional development. W-25

(DEIS, Page 4-76, Section 4.3.3.9 **Mitigation Summary)** Although possible mitigation measures are identified in the Biological Assessment in Appendix G, the DEIS does not clearly state if the general measures directed at protecting TES habitat will be required. W-26

The mitigation measures identified in the DEIS and Biological Assessment must be implemented in order to avoid jeopardy opinion under Section 7 of the Endangered Species Act. The use of standard no surface occupancy and prohibiting construction activity to protect TES critical habitat and nesting areas is widely used in BLM programmatic EISs. This approach must be incorporated into this EIS in order to provide adequate protection of federal, state TES and SUIT species of concern. W-27

The Biological Assessment recommends the following for the southwestern willow flycatcher. "Surveys should be conducted in areas of suitable breeding habitat during the appropriate season W-28

(late May through mid July) each year prior to initiation of site-specific project activities each year to determine presence or absence of the southwestern willow flycatcher and to determine if nesting is occurring in the Study Area; if so, then no surface disturbing activities would be allowed from late May through mid July. Disturbances should be minimized in areas of dense wooded riparian vegetation since it provides nesting habitat for the southwestern willow flycatcher." These recommendations must be adopted in the EIS and ROD. W-28 (cont

AIR QUALITY ANALYSIS

General Comment

EPA finds that the air quality analysis, in the draft EIS and the Technical Support Document, is exceptionally well written with thorough information on modeling methodologies and results.

Specific Comments

(Air Quality Technical Support Document, page 43) Flat terrain vs. Complex terrain modeling. EPA understands the complexity of performing near-field air dispersion modeling without the knowledge of where compressor stations may be located and what their emission characteristics would be. However, under stable atmospheric conditions, emissions from combustion sources can concentrate in low-lying areas such as the Animas River Valley. For the residents living within the Reservation, EPA recommends that one modeling run be done for CO and NO_x impacts to the Bondad area from the following three existing compressor stations: Amoco High Flume, Vastar 8, and Red Cedar Bondad. Since CO data is missing for the Ignacio air monitoring station, this modeling effort would help to describe the existing air quality on the Tribal lands. W-29

(Air Quality Technical Support Document, page 11) forth paragraph, last sentence. Recommend that a statement be added to this paragraph stating that the emissions from the proposed action of adding 118,000 hp of gas compression was not included in the Phase I increment analysis (performed by the State of Colorado). W-30

(DEIS, page 4-10 last paragraph) Recommend that a "safe-distance setback" be established for drilling rigs so that SO_2 concentrations will not exceed Colorado's 3-hr standard at nearby residences. W-31

(DEIS, Tables 4-1, 4-2, 4-3, 4-4) The presentation of PSD Class I increment impacts along with visibility impacts and lake impacts by analyzing the effects of mitigating NO_x emissions from compressors is very beneficial to the public and the decision-maker. Even though BLM does not have jurisdiction for air emissions on Tribal lands, the decision-maker can recommend (not commit to) mitigation W-32

based on the environmental impacts and the public comments concerning impacts. W-32

(DEIS, Table 4-3) This table presents information showing the least number of days of visibility impacts occurs with a 1.0 gr/hp-hr emission rate for compressors. EPA encourages the decision-maker to recommend the lowest emission rate in the ROD since the newly promulgated Regional Haze Rule will require states to develop plans to reduce visibility impacts in Class I areas. In addition, additional development of oil and gas will likely occur in the San Juan Basin during the next 20 years, and the impacts of this new development will be in addition to those occurring from the Proposed Action. W-33

Responses to Comment W from Cynthia Cody, US Environmental Protection Agency

W1 The Record of Decision (ROD) will establish the mitigation that is required as a condition of approval for the selected Alternative.

W2 We have rewritten the EIS and Biological Assessment to establish mitigation requirements firmly. These requirements would be adopted in the ROD, after Section 7 consultation with the USFWS has been completed. For clarification, mitigation specific to individual projects would be applied at a point in the process when individual projects are analyzed in a project EA and site-specific Biological Assessment. This second level of analysis, in contrast with the programmatic level, provides the assurance that mitigation measures are applied to specific proposals in the future. Site-specific NEPA analysis would tier to the FEIS and associated ROD.

W3 Under the proposed Alternatives, if construction activity were to occur in wetland areas, compliance with site-specific COE 404 Permits would be required of all operators. As described in the EIS, wetlands in the Study Area are generally associated with areas of wooded riparian vegetation. This vegetation type tends to occur in relatively small areas that are easy to avoid because of their size. In all cases, wetlands will be avoided preferentially when locations for individual projects are determined (Section 4.3.1.7). This will not only preserve wetlands but also several other resources, such as culturally important plants, TES, water, and soils. The 171-acre total potential wetland impact is an estimate of maximum potential impact without mitigation. It assumes that every wooded riparian area is a wetland, which it is not, and that every acre would be impacted, rather than avoided. Actual wetland impacts should be significantly less and mitigated by the terms of the COE 404 permit.

W4 Under the proposed Alternatives, if construction activity were to occur in wetland areas, compliance with site-specific COE 404 Permits would be required of all operators. Wetlands in the Study Area are situated within areas of wooded riparian vegetation. About 171 acres of this vegetation type could potentially be disturbed by the Preferred Alternative. Wooded riparian vegetation tends to occur in relatively small areas that will be avoided preferentially when locations for individual projects are determined (Section 4.3.1.7 and 4.3.1.8). It should be noted that the 171 acres is a worst-case disturbance scenario, and most of that 171-acre area is actually wooded riparian vegetation. Only a small percentage of the wooded riparian vegetation would qualify as wetlands.

W5 Whether wetlands can be avoided would be determined on a project-specific basis. Where this is not possible, individual NEPA documents would describe which Alternatives were considered and the reasons why the wetland area cannot be avoided. Compliance with these regulations would be handled at the APD stage and be assessed in consultation with the Army COE.

The mitigation measures presented in Section 4.3.1.8 are fully consistent with the CEQ regulations and EO 11990. Alternatives are not required to eliminate impacts in their entirely. That would be our goal at the outset, but we also realize that, as projects are implemented, some impacts may be unavoidable.

W6 Site-specific planning will determine whether wetlands can be avoided entirely or whether other mitigation approaches would have to be adopted. We cannot state with certainty at a programmatic level, absent site-specific proposals, that a particular resource would not be impacted. We can anticipate that some additional roads and pipelines would be needed to access new well sites. It is incorrect to assume that existing roads are, in all cases, adequate to access new sites and therefore, wetlands would not be involved.

W7 The revised Biological Assessment (Appendix G) addresses mitigation measures for individual threatened or endangered species. These measures, after Section 7 consultation with the USFWS has been completed, would be incorporated as requirements in the Record of Decision.

W8 Methane in shallow aquifers comes from various sources, some naturally occurring and some man-made. There are reports of methane in shallow water wells before CBM development, and outside the region of conventional gas development. The source of the methane in these wells has been postulated as biogenic methane, based on the methane isotopic composition.

The origin of this methane is either a local source (shale beds rich in organic matter within the aquifer system) or a deeper one, such as the Fruitland Formation. Methane transport from the Fruitland Formation to the shallow aquifer system may be explained by the following mechanism. Fruitland coals are saturated with respect to methane at pre-development reservoir pressures. There has been a dynamic flow system near the outcrop (6-8 miles from the outcrop into the basin). This flow system may carry oxygenated water with nutrients needed by bacteria to generate additional methane within the coalbeds. Excess methane will be released as a free-phase gas, because the coal is already saturated. The free gas migrates through the overlying Kirtland Shale via tortuous channels, as a Light Non-Aqueous Phase Liquid (LNAPL). This mechanism is independent of CBM development.

Given the high artesian pressures in the Fruitland Formation before CBM development, and the distinct water-chemistry difference between the Fruitland Formation and the shallow basin aquifers, there is little evidence that methane from the Fruitland Formation is entrained in water migrating from deep to shallow aquifers. If there was significant leakance from the Fruitland Formation to shallow aquifers, there would be lower pressures in the Fruitland, and a Fruitland water-chemistry signature in the shallow aquifers.

CBM development increases the amount of free-phase methane in the Fruitland coals, and may increase the transport of methane into the shallow aquifers of the basin. Given the complex

characteristics of two-phase flow, it is impossible to determine the actual pathways from the Fruitland Formation to the shallow aquifers. In shallow water wells within the historic conventional gas development area, thermogenic methane is prevalent, and the BLM is requiring well testing to ensure that offending gas wells are identified and fixed.

W9 The Southern Ute Indian Tribe is investigating new management approaches. These include studies to mitigate surface seeps at the outcrop within the Reservation, as well as continuing to identify gas wells that may be methane sources to shallow aquifers.

W10 We have revised the Purpose and Need section of the EIS.

W11 We believe mitigation measures in the DEIS and FEIS would avoid impacts or reduce them to an insignificant level for these areas and species. Riparian areas and critical habitat for Threatened and Endangered Species are identified in the DEIS (Section 3.3.2.1, Vegetation Types, the Biological Assessment/Appendix G, and throughout Chapter 4). Directional drilling would be used where appropriate, as described in Section 2.8.4.4. Existing well pads and roads would be used wherever possible, as described throughout Chapters 2, 3, and 4 of the EIS.

W12 The discussion of past impacts on the referenced resources is contained in Chapter 3, Affected Environment. In fact, this is the basis for discussions of the affected environment. The Chapter 3 introduction has been revised to indicate that past impacts were considered in the description of the affected environment.

W13 Historically, the SUIT Department of Energy and Minerals has worked closely with the SUIT Department of Natural Resources in an attempt to preserve and protect sensitive areas, such as wetlands. There is little doubt that wetland areas have been impacted to some degree in the past as a result of pipelines crossing rivers. However, appropriate 404 permits were obtained, and mitigation developed in conjunction with the Army COE.

W14 The cumulative-impacts section of the FEIS includes a description and estimation of the surface disturbance related to oil and gas development to date.

W15 We have rewritten Section 2.8.5.1 to describe more fully cavitation procedures and impacts from flaring.

W16 Any required mitigation measures will be incorporated in the Record of Decision.

W17 Please see Comment Response M2.

W18 Section 3.5.1.3 has been revised in response to this comment, and a new map (Map 28) has been included in the FEIS, showing the locations of the critical Study Areas in La Plata County, Colorado.

W19 Methane may migrate along a combination of these pathways from deeper reservoirs to shallow aquifers.

The published literature on fracture propagation does not support the hypothesis that hydro-fracturing creates vertical pathways from the deep gas reservoirs to the shallow aquifers. Published articles on fracture propagation in coal shows that for 50% of the cases, fractures do not penetrate overlying and underlying shale beds. For the other 50% of the cases, the fractures in overlying shale typically do not extend more than a few feet into the shale (W.P. Diamond, 1987).

W20 Past impacts on the vegetation types in the Study Area are described in Table 4-52 and Section 4.13. Wetlands are a subset of the wooded riparian vegetation type, which has seen a maximum of 200 acres of disturbance to date. The tribes follows a policy of wetland avoidance.

For the purpose of this EIS, we have not completed wetland mapping because collection of that data would not add substantively to the programmatic evaluation and planning accomplished by this EIS. Actual project planning involves site-specific wetlands mapping and avoidance. That is the point in our staged decision-making process when the information is critical, and the point when mitigation is applied.

W21 Cumulative effects on these resource elements or impact indicators are addressed in Section 4.13 and Table 4-52. There is no hard and fast inventory of the total number of acres impacted by noxious weeds, nor a quantitative indication of how gas field development has impacted that total to date. It is the policy of the SUIT and BIA, however, to control noxious weeds on the Reservation aggressively. Weed control is a specific condition of approval for oil and gas activities on the Reservation (please refer to Appendix E).

W22 The tribe and BIA conduct an aggressive program of weed control. Operators are required to control noxious weeds in project areas, and seed used for reclamation must be certified free of noxious-weed seed. (See Appendix E.)

All individual projects are designed to meet the intent of Executive Order 11990. When this is not possible, individual NEPA documents will describe which Alternatives were considered and the reasons why the wetland area cannot be avoided. Compliance with these regulations would

be handled at the ROW permitting or APD stage.

We have rewritten the wetlands mitigation in Section 4.3.1.8 to reflect the intent of Executive Order 11990 more clearly.

Executive Order 13112 is directed broadly at the Federal agencies, particularly the research component. We follow the guidelines of EO 13112 in carrying out the weed control program on the Reservation. General guidelines that apply to all resource programs include invasive-species monitoring, prevention of introduction of invasive species, noxious-weed treatment, and site reclamation using native-seed mixture, as specified in EO 13112, Section 2. We have added this direction to Section 4.3.1.8.

W23 The tribe and BIA avoid "highly functioning" wooded riparian areas wherever possible. These are of special concern to the tribe, as many culturally important vegetation species (i.e., cottonwood, willows) grow in them. As necessary, the use of temporary bridges or directional boring would be considered to avoid impacting wetlands. It is the policy of the tribe to use liners or lined berms for refueling, maintenance, and storage areas, to protect against spills. This mitigative measure would be outlined in the operator's ECBM Environmental and Safety Contingency Manual, as discussed in Section 4.12. Spill prevention plans are incorporated into all applicable oil and gas development permits.

W24 As discussed in Section 4.3.1.7, "Wooded riparian vegetation tends to occur in relatively small areas that could be preferentially avoided when locations for individual projects are determined." Avoidance is the first line of mitigation. Please refer to Section 4.3.1.8. Also refer to the Biological Assessment (Appendix G).

W25 We have rewritten Section 4.3.3.4 to include a discussion of potential willow flycatcher impacts. Please refer also to the Biological Assessment (Appendix G). At the programmatic scale of analysis addressed in this EIS, it is difficult to ascertain overall species impacts, but broad management guidelines are presented. Potential impacts on individual birds and their habitat would be identified and mitigated in response to site-specific project proposals.

W26 The Record of Decision will establish the mitigation requirements.

W27 The mitigation established in this EIS, as determined by the ROD, would be implemented at the site-specific project level. Numerous mitigation approaches can and will be used, ranging from site avoidance (moving a well pad to another location within a well window, or applying a variance that places the well outside the window), to timing limitations that prohibit construction during certain critical times of year, to outright cancellation of activities where they may result in a taking under Section 9 of ESA. Site-specific biological assessments would be conducted when

proposals are advanced, and consultation with the USFWS would proceed if "may affect" determinations are reached.

W28 These survey measures are outlined in the Biological Assessment and would be adopted in the ROD, after Section 7 consultation with the USFWS is completed.

W29 As described on pages 43 and 46 of the Air Quality Technical Support Document (Dames and Moore 2000):

> The purpose of this analysis is to determine if the assumed development activity could occur without causing significant adverse air quality impacts. A logical approach is to determine if this result can be achieved for a flat terrain scenario. If violations were predicted for this case, then a modification of the project would be necessary. To ensure that this question is answered in a reasonably conservative manner, all new compressor stations were analyzed at the maximum stage of potential development, assuming that all sources were operating simultaneously at potential or permitted emissions. This is a very unlikely scenario in real life.
>
> Given the preliminary and speculative nature of the programmatic EIS, it is appropriate that the near-field analysis did not incorporate terrain features. There is no site-specific information available regarding development locations or equipment. Since air pollutant dispersion modeling is very sensitive to the emission source locations relative to terrain features, the use of hypothetical locations would be misleading to the public and decision makers. If a site-specific development proposal is developed, detailed emission source information, locations and terrain features could then be assessed (i.e., further detailed analysis at the time of permitting by the appropriate air regulatory agency).

In addition, the following Regulatory Default Options of the ISCST3 model were applied:

- Use final plume rise
- Use stack-tip downwash
- Use buoyancy-induced dispersion
- Use calms processing routine
- Do not use missing data processing routine
- Use default wind profile exponents
- Use default vertical potential temperature gradients
- Use "upper bound" values for super squat buildings
- Do not use exponential decay for Rural Mode

If the EPA is concerned about potential specific CO and NO_x impacts on the Bondad area from existing compressor stations, we can provide copies of the non-steady state, complex terrain CALMET/CALPUFF modeling input parameters used in the DEIS far-field air quality impact

assessment to your air quality modeling staff.

W30 The reference in the Air Quality Technical Support Document (Dames and Moore 2000) to the State of Colorado's Phase I Nitrogen Dioxide PSD Increment Consumption Analysis in Southwest Colorado (CDPHE 1999), which demonstrated NO_2 increment levels had not been exceeded, was made to indicate that responsible air quality regulatory agencies could perform such an analysis.

This reference followed the statement,

> Modeling was conducted [for the DEIS] to demonstrate that the assumed development would not exceed the NO_2 PSD Class II increment. The intent of this analysis was not to conduct a rigorous PSD increment consumption analysis, but rather to provide an indication that the increment would not be exceeded as a result of the assumed development (including all Alternatives). It is beyond the regulatory authority of BLM to conduct a PSD increment consumption analysis.

It would be inappropriate for the State of Colorado to conduct a rigorous PSD increment consumption analysis including the hypothetical 118,000 hp of gas compression assumed in the programmatic DEIS. Such analyses must be legally defensible, based on Federal and State legislation and regulations, as well as on specific Attorney General's opinions and decisions.

W31 As stated in the DEIS (page 4-10 through 4-11; Chapter 4; 4.2 AIR QUALITY AND CLIMATE; 4.2.5 Alternative 3 - Enhanced Coalbed Methane Recovery):

> The maximum short-term (3- and 24-hour) SO_2 emissions would be generated by drilling rigs and other diesel engines used during rig-up, drilling, and completion operations (sulfur is a trace element in diesel fuel). These SO_2 emissions would be temporary, occurring only during the limited construction period at each well location. The maximum modeled concentrations (including representative background values) would be nearly 702 $\mu g/m^3$ (3-hour) and 133 $\mu g/m^3$ (24-hour).
>
> Therefore, predicted short-term SO_2 concentrations would be slightly above the restrictive Colorado SO_2 Ambient Air Quality Standards of 695 $\mu g/m^3$ (3-hour) and well below 365 $\mu g/m^3$ (24-hour). The 3-hour SO_2 National Ambient Air Quality Standard (1,300 $\mu g/m^3$) is less stringent. Given the conservative assumptions used in the 3-hour modeling analysis, and the limited spatial applicability of the Colorado standard, significant impacts are unlikely to occur, even when compared to the more restrictive standard.

Given the "programmatic" nature of the DEIS, specific source locations are not known. Although it is possible that an actual source could be located where the 3-hour Colorado Ambient Air Quality Standard would be applicable, given that SO_2 emissions would occur only

during the limited 36-day construction period at each well location, as well as the conservative assumptions used in the 3-hour modeling analysis, it would be inappropriate to establish a "safe-distance setback" based on a 7 $\mu g/m^3$ exceedance of Colorado's 3-hour SO_2 standard modeled in a programmatic DEIS. Therefore, no revision is necessary in the Final EIS.

W32 Please see Comment Response U60.

W33 As America's primary air quality regulatory agency, with oversight responsibility of all local, state, and tribal air quality regulatory agencies, EPA could establish a NO_x emission limit of 1.0 g/hp-hr for compressor engines nationally.

If additional development of oil and gas were to occur in the San Juan Basin during the next 20 years which requires that a Federal decision be made (beyond the development addressed in the DEIS), additional visibility-impact assessments would be conducted as part of those future NEPA analyses.

In addition, EPA and the applicable air quality regulatory agencies will be implementing the Federal Regional Haze regulations, designed to achieve the National Visibility Goal of "the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory [PSD] Class I Federal areas which impairment results from manmade air pollution."

Please also see Comment Response A2.

CHAPTER 6 - PREPARERS AND CONTRIBUTORS

CHAPTER 6 - PREPARERS AND CONTRIBUTORS

6.1 INTRODUCTION

This EIS was prepared under the direction of the BLM, BIA, and SUIT (Core Team) by Dames & Moore, Inc., an environmental and engineering consulting firm. Editorial assistance was provided by Pioneer Corporation USA. The Core Team conducted the scoping process and provided much of the baseline data. The consultant assisted with supplementing the baseline data, which served as a basis for the impact assessment. The impact assessment was completed jointly by the Core Team and consultant. The consultant prepared and assembled the DEIS text and maps, and the Core Team reviewed, edited, and approved the documents. Table 6-1 is a list of the individuals, including their education and experience and EIS involvement, who participated and/or contributed in the preparation of the EIS.

TABLE 6-1
Preparers and Contributors

Name and Title	Education and Experience	Involvement
BUREAU OF LAND MANAGEMENT LEAD FEDERAL AGENCY		
Jim Rhett, Colorado State Office ■ Environmental Protection Specialist	BS Geology ■ 24 years of experience	■ Document Coordination and Review
Jim Powers, San Juan Public Lands Center ■ Lands and Minerals Program Leader	MS Forest Resource Management ■ 23 years of experience	■ Document Coordination and Review (FEIS)
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CHAPTER 7 - REFERENCES

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CHAPTER 8 - GLOSSARY

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Abandonment - Termination of operations from production from a well. Permanent abandonment involves plugging the well and removal of the installations.

Acre-foot - A unit of volume of water for the amount covering one acre to a depth of one foot, equal to 43,560 cubic feet, or approximately 325,829 gallons or approximately 7758 barrels (bbls). (One cubic foot equals 7.48 gallons, one bbl equals 42 gallons)

Affected Environment - Surface or subsurface resources (including social and economic elements) within or adjacent to a geographic area that potentially could be affected by gas development and production activities. The environment of the area to be affected or created by the alternatives under consideration. (40 CFR 1502.15)

A-weighted - A weighting function applied to the noise spectrum, which approximates the response of the human ear.

Alkalinity - Quantity and type of compounds in water that collectively cause a pH shift to alkalinity.

Allotment (Range) - A designated area of land available for livestock grazing upon which a specified number and kind of livestock may be grazed under management of an authorized agency.

Alluvial Plains - Floodplains produced by the filling of a valley bottom and consisting of fine mud, sand, or gravel.

Alternative - A combination of management prescriptions applied in specific amounts and locations to achieve a desired management emphasis as expressed in goals and objectives. One of a number of plans or projects proposed for decision-making.

Animal Unit Months (AUM) - Amount of forage required to sustain a cow/calf unit for one month.

Annular – Having the form of a ring; ring-shaped.

Areas of Critical Environmental Concern (ACEC) - A BLM designation pertaining to areas where specific management attention is needed to protect and prevent irreparable damage to important historical, cultural, and scenic values, fish or wildlife resources, or other natural systems or processes, or to protect human life and safety from natural hazards.

Aspect - The direction in which a slope faces.

Barite (BaS04) - A mineral used to increase the weight of the drilling mud.

Basin - A depressed area having no surface outlet (*topographic basin*); a physiographic feature or subsurface structure that is capable of collecting, storing, or discharging water by reason of its shape and the characteristics of its confining material (*water*); a depression in the earth's surface, the lowest part often filled by a lake or pond (*lake basin*); a part of a river or canal widened (*drainage, river, stream basin*)

Benthic - Of, pertaining to, or living in or on the bottom of a waterbody.

Bentonite - A naturally occurring clay used to keep the cuttings in suspension as they move up the bore hole.

Biogenic Rock - An organic rock produced directly by the physiological activities of living organisms, either plant or animal; e.g., coral reefs, shelly limestone, pelagic ooze, coal, peat.

Blowout - An uncontrolled expulsion of gas, oil, or other fluids from a drilling well. A blowout occurs when formation pressure exceeds the pressure applied to it by the column of drilling fluid and when blowout prevention equipment is absent or fails.

Bored Crossing - A subterranean crossing of a road, railway, river, or other obstacle, by a pipeline, transmission line, or other transport system.

Bradenhead Testing - The bradenhead is the portion of the wellhead that is in communication with the annular volume between the surface casing and the next smaller casing string. Conceptually, if there is positive pressure at the bradenhead, this indicates that a casing leak or an inadequate cement job could exist on a well.

Brine - A highly saline solution.

Bureau of Indian Affairs - An agency of the Department of the Interior responsible for encouraging and assisting Indian people to manage their own affairs under the trust relationship to the Federal government; to facilitate, with the maximum involvement of Indian people, full development of their human and natural resource potential, and promote self-determination by using the skills and capabilities of Indian people in the direction and management of programs for their benefit.

Bureau of Land Management - An agency of the Department of the Interior responsible for managing most Federal government subsurface minerals. It has surface management responsibility for Federal lands designated under the Federal Land Policy and Management Act of 1976.

Cambrian - The oldest of the periods of the Paleozoic Era; also the system of strata deposited during that period.

Carbonaceous - Coaly; pertaining to, or composed largely of, carbon.

Carbon Isotope Ratios - The ratio of the most common carbon isotope, carbon-12, which is non-radioactive, to either of the less common isotopes, carbo-13 (non-radioactive) or carbon-14 (radioactive), or the reciprocal of one of these ratios. If unspecified, the term generally refers to the ratio (carbon-12/carbon-13).

Casing - Steel pipes of varying diameter and weight, joined together by threads and couplings,"inserted" into the well bole for the purpose of supporting the walls of the well and preventing them from caving in. Surface casing is inserted from the ground surface to approximately 250 feet, production casing is inserted to the total depth of the well (smaller diameter pipe than surface casing), cemented in place and latter perforated for production.

Centralizer - A device secured around the casing at various intervals to center the casing in the hole and provide a uniform cement sheath around the casing.

Christmas Tree - An assemblage of valves, located at the top of casing, from which tubing in the well is suspended.

Clean Air Act - Public Law 84-159, established July 14, 1955, and amended numerous times since. The Clean Air Act: establishes Federal standards for air pollutants emitted from stationary and mobile sources; authorizes states, tribes and local agencies to regulate polluting emissions; requires those agencies to improve air quality in areas of the country which do not meet Federal standards; and to prevent significant deterioration in areas where air quality is cleaner than those standards. The Act also requires that all Federal activities (either direct or authorized) comply with applicable local, state, tribal and Federal air quality laws, statutes, regulations, standards and implementation plans. In addition, before these activities can take place in non-attainment or maintenance areas, the Federal agencies must conduct a Conformity Analysis (and possible Determination) demonstrating the proposed activity will comply with all applicable air quality requirements.

Cleat - In a coal seam, a joint or system of joints along which the coal fractures.

Coal - A readily combustible rock containing more than 50 percent weight and more than 70 percent by volume of carbonaceous material including inherent moisture, formed from compaction and induration of variously altered plant remains similar to those in peat. Differences in the kinds of plant materials (type), in degree of metamorphism (rank), and in the range of impurity (grade) are characteristic of coal and are used in classification.

Coal Bed - A coal seam.

Coalbed Methane - A gas associated with a coal seam.

Cogeneration - Production of fuel-fired steam sold initially (usually to a utility) to generate electricity and subsequently to a private enterprise for product processing.

Colluvium - A general term applied to loose and incoherent deposits, usually at the foot of a slope or cliff and brought there chiefly by gravity. Talus and cliff debris are included in such deposits.

Completion - the activities and methods to prepare a well for production. Includes installation of equipment for production from an oil or gas well.

Conditions of Approval - Conditions or provisions (requirements) under which an Application for a Permit to Drill or a Sundry Notice is approved.

Connate Water - Water entrapped in the interstices of a sedimentary rock at the time the rock was deposited.

Conspecific - Of the same species.

Corridor - For purposes of this environmental assessment, a wide strip of land within which a proposed linear facility could be located.

Council on Environmental Quality (CEQ) - An advisory council to the President of the United States established by the national Environmental Policy Act of 1969. It reviews Federal programs for their effect on the environment, conducts environmental studies, and advises the president on environmental matters.

Cow-Calf Livestock Operation - A livestock operation in which a base breeding herd of mother cows and bulls is maintained. The cows produce a calf crop each year, and the operation keeps some heifer calves from each calf crop for breeding herd replacements. The operation sells the rest of the calf crop between the ages of 6 and 12 months along with old or non-productive cows and bulls.

Cretaceous - The third and latest of the periods included in the Mesozoic Era; also the system of strata deposited in the Cretaceous Period.

Critical Habitat - An area occupied by a threatened or endangered species "on which are found those physical and biological features (1) essential to the conservation of the species, and (2) which may require special management considerations or protection" (16 USC 1532 (5)(A)(I)1988). Unoccupied by suitable habitat for the threatened or endangered species is not automatically included unless such areas are essential for the conservation of the species (50 CFR 424.12(e)0.

Crucial Habitat - An area that is essential to the survival of any wildlife species sometime during its life cycle.

Cultural Resource Inventory Classes:

Class I - Inventory of existing data: A study of a defined area designed (1) to provide a narrative overview (cultural resource overview) derived from existing cultural resource information and (2) to provide a compilation of existing cultural resource site record data on which to base the development of the BLM's site record system.

Class III - An intensive field inventory designed to locate and record, from surface and exposed profile indications, all cultural resource sites within a specified area. A Class III inventory is appropriate on small project areas, all areas to be disturbed, and primary cultural resource areas.

Cultural Resources - Remains of human activity, occupation, or endeavor, as reflected in sites, buildings, artifacts, ruins, etc.

Cumulative Impact - The impact on the environment that results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

Cuttings - Fragments of rock dislodged by the bit and brought to the surface in the drilling mud.

Debitage (cultural resources) - Waste flakes from tool-making activities.

Depth of Burial - The depth below the ground surface and/or thickness of overlying stratum over a particular rock unit of geologic interest. Coals buried at a depth of more than 4,000 feet do not have the flow capacity needed for economic methane gas development.

Depth to Coal Pay - The depth below the ground surface of a potential economic coal unit.

Desiccation - The removal of moisture; to become dried up.

Development Well - A well drilled within the known or proven productive area of an oil field with the expectation of producing oil or gas from the producing reservoir.

Dewatering - The act of removing water.

Directional Drilling - The intentional deviation of a wellbore from vertical to reach subsurface areas off to one side from the drilling site.

Disposal Well - A well into which produced water from other wells is injected into an underground formation for disposal.

Diurnal - Describes a cyclic event recurring daily; or the nature or habit of an organism to be active during daylight hours.

Drilling Fluids - The circulating fluid used to bring cuttings out of the wellbore, cool the drill bit, provide hole stability, and pressure control.

Drilling Rig - The derrick, draw-works, and attendant surface equipment of a drilling or workover unit.

Drilling - The operation of boring a hole in the earth, usually for the purpose of finding and removing subsurface formation fluids such as oil and gas.

Dry Hole - Any well incapable of producing oil or gas in commercial quantities. A dry hole my produce water, gas, or even oil, but not enough to justify production.

Embargo - A restriction imposed on commerce by law; especially a prohibition of trade in a particular commodity.

Emission - Air pollution discharge into the atmosphere, usually specified by mass per unit time.

Endangered Species - Any animal or plant species in danger of extinction throughout all or a significant portion of its range.

Enhanced Recovery - The use of artificial means to increase the amount of hydrocarbons that can be recovered from a reservoir. A reservoir depleted by normal extraction usually can be restored by secondary or tertiary methods of enhanced recovery.

Entrained Methane - Methane that is picked up and carried along; the collecting and movement by currents.

Erosion - The group of processes whereby earthy or rocky material is worn away by natural sources such as wind, water, or ice and removed from any part of the earth's surface.

Ephemeral Stream - A stream that flows only in direct response to precipitation.

Exploration Well - A well drilled in the area where there is no oil or gas production (also known as wildcat well).

Exsolve - From exsolution, the process whereby an initially homogeneous solid solution separates into two (or possibly more) distinct crystalline phases without addition or removal of material to or from the system; i.e., without change in the bulk composition. I generally, though not necessarily, occurs on cooling. Synonym: *unmixing.*

Eyrie - The nest of birds of prey.

Fan - An accumulation of debris brought down by a stream descending through a steep ravine and debouching in the plain beneath, where the detrital material spreads out in the shape of a fan, forming a section of a very low cone.

Federal Candidate Species - Sensitive wildlife species currently under consideration for inclusion to the list of Federal threatened or endangered species. Species are placed in one of the following categories:

1. Available data on biological vulnerability and threat(s) support listing, but additional data are needed on precise habitat and/or critical habitat boundaries.

2. Available data indicate that listing may be appropriate, but substantial data on vulnerability and threats are not available to support immediate listing.

3A. Probably extinct.

3B. Taxa do not meet the USFWS definition of species; taxa may be re-evaluated in the future.

3C. Taxa that have proven to be more abundant or widespread than was previously believed and/or those that are not subject to any identifiable threat; further research may indicate re-evaluation to Category 1 or 2.

Federal Land Policy and Management Act of 1976 (FLPMA) - Public Law 94-570 signed by the President of the United States on October 21, 1976. Established public land policy for management of lands administered by the Bureau of Land Management (BLM).

Federal Listed Species - Animal or plant species listed by the USFWS as threatened or endangered.

Fiduciary - Held in trust.

Flare - An arrangement of piping and a burner to dispose of surplus combustible vapors, usually situated around a gasoline plant, refinery, or producing well.

Floodplain - The flat ground along a stream that is covered by water when the stream overflows its banks at flood stages.

Forage - All browse and herbaceous foods available to grazing animals, which may be grazed or harvested for feeding.

Foreground View - The landscape area visible to an observer within a mile.

Formation - A body of rock identified by lithic characteristics and stratagraphic position; it is prevailingly, but not necessarily tabular, and is mappable at the earth's surface or traceable in the subsurface (NACSN, 2984, Art. 24).

Fossil - Any remains, trace, or imprint of a plant or animal that has been preserved by natural processes in the earth's crust since some past geologic time.

Fractured - Fissured, broken, or cracked. See also Hydraulic Fracturing.

Free Market - An economic market operating by free competition.

Fugitive Dust - Airborne particles emitted from any source other than through a controllable stack or vent.

Game Management Unit (GMU) - Colorado is divided into approximately 150 geographic areas called Game Management Units. Game species are managed on a unit specific basis.

Habitat - A specific set of physical conditions that surround a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and living space.

Habitat Type - An aggregation of all land areas potentially capable of producing similar plant communities at climax.

Herpetofauna - Reptiles and amphibians.

Highest and Best Use - Use of a resource (i.e., property) that maximizes its potential.

Historic - Archaeological and archivally known sites related to the activities of non-native peoples, whether they be of Euro-American, Afro-American or Asian-American origin, in the period after the European discovery of the New World (ca. A.D. 1492).

Hydraulic Fracturing - A method of stimulating production by increasing the permeability of the producing formation.

Hydric Soils - Saturated soils.

Hydrocarbons - Organic compounds of hydrogen and carbon, whose densities, boiling points, and freezing points increase as their molecular weights increase. Although composed only of carbon and hydrogen, hydrocarbons exist in a great variety of compounds, owing to the strong affinity of the carbon atom for other atoms and itself. The smallest molecules are gaseous; the largest are solids. Petroleum is a mixture of many different hydrocarbons.

Hydrogeologically Connected - The connection of two or more hydrologic systems, usually refers to separate aquifers in which water can pass and exchange with other aquifers.

Hydrophytic - Water-loving; ability to grow in water or saturated soils.

Hydrostatic Test - The testing of pipeline integrity by closing of all openings and pumping water into the pipe at a pressure greater than the normal operating pressure to determine whether or not leaks are present.

Immigrant - Individual who moves into the project area from another part of the country.

Impact - A modification of the existing environment caused by an action (such as construction or operation of facilities).

Incised Channels - Deeply and sharply cut stream channels.

Indian Mineral Estate - A mineral estate owned by the Federal government and held in trust for the Indian people. The Bureau of Indian Affairs and Bureau of Land Management, as agents of the Secretary of the Interior, have the responsibility for administering the leasing and development of oil and gas resources in such a case. However, under the auspices of the Indian Self Determination Act of 1968 and Indian Mineral Development Act of 1982, Indian people may take a leadership role in the management of their mineral resources.

Indicator Species - A species of animal or plant whose presence is a fairly certain indication of a particular set of environmental conditions. Indicator species serve to show the effects of development actions on the environment.

Indirect Impacts - Secondary effects that occur in locations other that the initial action or later in time.

Infrastructure - The facilities, services, and equipment needed for a community to function including roads, sewers, water lines, police and fire protection, and schools.

Injection - The forcing, under abnormal pressure, of material (downward from above, upward from below, or laterally) into a pre-existing deposit or rock, either along some plane or weakness or into a pre-existing crack or fissure.

Injection Well - A well used to inject fluids into an underground formation to increase reservoir pressure.

Insignificant or Non-significant Impacts - Impacts that are perceptible or measurable relative to those occurring naturally or due to other actions, and would not exceed significance criteria.

Intermittent Stream - A stream or reach of a stream that is below the local water table for at least some part of the year.

Joint Patterns - Patterns of fractures in rock, generally vertical or transverse to bedding, along which no appreciable movement has occurred.

Jurisdiction - The legal right to control or regulate use of a transportation facility. Jurisdiction requires authority, but not necessarily ownership.

K-factor - Soil erodibility factor.

Landscape - An area composed of interacting ecosystems that are repeated because of geology, landform, soils, climate, biota, and human influences throughout the area. Landscapes are generally of a size, shape, and pattern which is determined by interacting ecosystems.

Landscape Character - Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.

Landscape Setting - The context and environment in which a landscape is set; a landscape backdrop.

Lease - (1) A legal document that conveys to an operator the right to drill for oil and gas; (2) the tract of land, on which a lease has been obtained, where producing wells and production equipment are located.

Lek - An area where grouse gather for ritualistic display and breeding; also, a sage grouse strutting ground.

Lenticular - Shaped approximately like a double convex lens.

Level of Service (LOS) - In transportation studies, a qualitative measure of traffic flow along a given road considering a variety of factors, including speed and travel time, traffic interruptions and freedom to maneuver. Levels of service are designated "A" through "F"; "A" being a free-flow condition with low volumes at high speeds and "F" being a congested condition of low speeds and stop-and-go traffic. Intermediate levels describe conditions between these extremes. A level of service below "C" involves unstable to forced traffic flow in which a driver's freedom to select a speed is restricted and in which traffic stoppages cause congestion.

Liquefaction - A change in the phase of a substance to the liquid state; usually a change from the gaseous to the liquid state, especially of a substance that is a gas at normal pressure and temperature.

Lithic Scatter - A scatter of chipped stone materials, which may include fragments, flakes, or stone tools.

Lithology - The physical characteristics of a rock, generally as determined megascopically or with the aid of a low-power magnifier.

Logging Tool - Electric tools that are able to be lowered down a well bore by wire cable and are capable of taking measurements of the physical properties of the rock formations downhole (i.e., resistivity, self-potential, gamma-ray, intensity, or velocity). The data is recorded and displayed on well logs that aid in defining physical rock characteristics such as lithology, porosity, pore geometry, and permeability.

Management Indicator Species - Those species that are commonly hunted or whose habitat requirements and population changes are believed to indicate effects of management activities on a broader group of wildlife species in the ecological community.

Middleground View - One of the distance zones of a landscape being viewed. This zone extends from the limit of the foreground to three to five miles from the observer.

Migration (oil and gas) - the movement of liquid and gaseous hydrocarbons from their source or generating beds, through permeable formations into reservoir rocks.

Mineral Reserves - Known mineral deposits that are recoverable under present conditions but are as yet undeveloped.

Mineral Rights - Mineral rights outstanding are third-party rights, an interest in minerals not owned by the person or party conveying the land to the United States. It is an exception in a deed that is the result of prior conveyance separating title of certain minerals from the surface estate.

Reserved mineral rights are the retention of ownership of all or part of the mineral rights by a person or party conveying land to the United States. Conditions for the exercising of these rights have been defined in the Secretary of the Interior's "Rules and Regulations to Govern Exercising of Mineral Rights Reserved Conveyance to the United States" attached to and made a part of deeds reserving mineral rights.

Mitigation - The abatement or reduction of an impact on the environment by (1) avoiding a certain action or parts of an action, (2) employing certain construction measures to limit the degree of impact, (3) restoring an area to preconstruction conditions, (4) preserving or maintaining an area throughout the fife of a project, or (5) replacing or providing substitute resources to the environment or (6) gathering archaeological and paleontological data before disturbance.

Multiple Use - Multiple use as defined by the Multiple Use - Sustained Yield Act 1960 means the management of all the various renewable surface resources so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will given the greatest dollar return or the greatest unit output.

National Ambient Air Quality Standards (NAAQS) - The allowable concentrations of air pollutants in the air specified by the Federal government. The air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public welfare from any unknown or expected adverse effects of air pollutants).

National Environmental Policy Act of 1969 (NEPA) - An Act that encourages productive and enjoyable harmony between man and his environment and promotes efforts to prevent or eliminate damage to the environmental and biosphere and stimulate the health and welfare of man; enriches the understanding or the ecological systems and natural resources important to the Nation, and establishes the Council on Environmental Quality.

National Natural Landmarks - Sites designated by the Secretary of the Interior as containing the best representative examples of geologic features and natural communities composing the nation's natural history. The purpose of the designation is to encourage preservation of such sites through well-informed management and use, and consideration of these sites in public and private land use

planning. Designation has no legal effect on land ownership, use, or management (National Park Service, not date, National Natural Landmark Designation).

Negligible Impact - Impact that is small in magnitude and importance and are difficult or impossible to quantify relative to those occurring naturally or due to other actions.

Non-Conventional Energy Sources - Energy sources not commonly used (e.g., solar energy).

Non-Range - Areas that are not suitable for livestock grazing due to low forage production, steep slopes, dense brush, or other reasons.

Notice of Review Species - A species that is being considered as a candidate for listing as either endangered or threatened under the Endangered Species Act of 1973, as amended.

Noxious Weed - An undesirable weed species that can crowd out more desirable species.

Off-Highway Vehicle (OHV) - A vehicle (including four-wheel drive, trail bikes, all-terrain vehicles, and snowmobiles but excluding helicopters, fixed-wing aircraft, and boats) capable of traveling off road over land, water, ice, snow, sand, marshes, and other terrain.

One-Hundred-Year Flood - A hydrologic event with a magnitude that has a recurrence interval of 100 years.

Paleontology - A science dealing with the life of past geological periods as known from fossil remains.

Palustrine - A system of wetlands that includes all non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens.

Particulate Matter - A particle of soil or liquid matter (e.g., soot, dust, aerosols, fumes and mist).

Peidmont - Lying or formed at the base of mountains.

Perennial Stream - A stream receiving water from both surfaces and underground sources that flows throughout the entire year.

Perforations - Holes that are made through the casing and cement, and extend some distance into the production zone.

pH - A numeric value that gives the relative acidity or alkalinity of a substance on a 0 to 14 scale with the neutral point at 7. Values lower than 7 show the presence of acids, and values greater than 7 show the presence of alkalis.

Plan of Development - A mandatory plan, developed by an applicant of a mining operation or construction project, that specifies the techniques and measures to be used during construction and operation of all project facilities on public land. The plan is submitted for approval to the appropriate Federal agency before any construction begins.

Plug - Any object or device that serves to block a hole or passageway, as a cement plug in a borehole.

Prehistoric - Archaeological sites resulting from the activities of aboriginal peoples native to this region, and because dating is often difficult, extending up to the reservation era (ca. A.D. 1868).

Prevention of Significant Deterioration (PSD) - A regulatory program under the Clean Air Act (P.L. 84-159, as amended) to limit air quality degradation in areas currently achieving the National Ambient Air Quality Standards. The PSD program established air quality classes in which differing amounts of additional air pollution is allowed above a legally defined baseline level. Almost any additional air pollution would be considered significant in PSD Class I areas (certain large national parks and wilderness areas in existence on August 7, 1977, and specific Tribal lands redesignated since then.) PSD Class II areas allow that deterioration associated with moderate, well-controlled growth (most of the country). Although Class III areas would allow greater incremental impacts planned individual growth, no Class III areas have been established.

Primary Range - Areas where the majority of livestock grazing is concentrated, due to high forage production, easy accessibility, nearby water sources, or other reasons.

Prime Farmland - Land that is best suited for producing food, feed, forage, fiber, and oilseed crops. The inventory of prime agricultural land is maintained by the USDA Natural Resources Conservation Service, (formerly the Soil Conservation Service).

Production Well - A well drilled in a known field that produces oil or gas.

Proposed Action - Construction activities, alignments, and other activities proposed by the applicant.

Proppants - Sandgrains, aluminum pellets, glass beads, or similar materials used in hydraulic fracturing. When injected into the production formation, these materials leave channels allowing gas to flow through them into the well.

Quaternary - The younger of the two geologic periods or systems in the Cenozoic Era.

Rare or Sensitive Species - Species that have no specific legal protection under the Endangered Species Act as threatened or endangered species, but are of special concern to agencies and the professional biologic community due to low populations, limited distributions, ongoing population decline, and/or human or natural threats to their continued existence.

Reasonable Foreseeable Development Scenario – The prediction of the type and amount of oil and gas activity that would occur in a given area. The prediction is based on geologic factors, past history of drilling, projected demand for oil and gas, and industry interest.

Reciprocation - A technique performed while cementing, whereby casing is moved up and down the wellbore in order to move the cement slurry uniformly around the wellbore to eliminate channelling and provide an effective cement bond on the casing and formation walls.

Reclamation - The process of converting disturbed land to its former use or other productive uses.

Rest Rotation Grazing System - A grazing system in which one of several pastures in an allotment or group is "rested" (not grazed) each year, with each pasture being rested in turn.

Record of Decision - A document separate from, but associated with, an environmental impact statement that publicly and officially discloses the responsible official's decision on the proposed action.

Reserve Pit - (1) Usually an excavated pit that may be lined with plastic that holds drill cuttings and waste mud. (2) Term for the pit that holds the drilling mud.

Reservoir (oil and gas) - A naturally occurring, underground container of oil and gas, usually formed by deformation of strata and changes in porosity.

Riparian - Situated on or pertaining to the bank of a river, stream, or other body of water. Normally used to refer to the plants of all types that grow along, around, or in wet areas.

Riverine - A system of wetlands that includes all wetland and deep-water habitats contained within a channel that lacks trees, shrubs, persistent emergents, and emergent mosses or lichens.

Rotation - A technique performed while cementing, whereby casing is rotated in the hole in order to move the cement slurry uniformly around the casing to eliminate channelling and provide an effective cement bond on the casing and formation walls.

Salinity - A measure of the amount of dissolved salts in water.

San Juan Basin - A large geologic basin located in northwestern New Mexico and southwestern Colorado that has been extensively drilled for oil and gas and is reportedly the second largest gas-producing basin in the continental United States. (A summary of the mineral development history is provided in Chapter 1.)

Saline water - Water containing high concentrations of salt (see also brine).

Scoping - A term used to identify the process for determining the scope of issues related to a proposed action and for identifying significant issues to be addressed in an EIS.

Scraper Trap - A device on the pipeline used to receive a scraper pig or inside pipe inspection pig.

Scratchers - A device fastened to the outside of the casing that removes drilling mud from the wall of the hole to condition the hole for cementing. By rotating or moving the casing up and down as it is being inserted into the hole, the scratcher, formed of stiff wire, removes drilling mud so that cement can bond solidly to the formation wall.

Screened - The depth at which a well screen has been placed on a well. A well screen allows fluids to enter the well casing.

Secondary Range - Areas where livestock grazing occurs but at lower intensities than primary range, due to less favorable conditions of forage production, terrain, distance from water source, or other factors.

Secondary Succession - The process by which ecosystems recover toward pre-existing conditions after removal of a disturbance, such as the recovery process of a forest after a fire.

Sediment - Soil or mineral transported by moving water, wind, gravity, or glaciers, and deposited in streams or other bodies of water, or on land.

Sensitive Plant Species - Those plant or animal species susceptible or vulnerable to activity impacts or habitat alterations.

Sensitivity Levels (visual resources) - A measure of people's concern for scenic quality.

Significant - An effect that is analyzed in the context of the proposed action to determine the degree or magnitude of importance of the effect, either beneficial or adverse. The degree of significance can be related to other actions with individually insignificant but cumulatively significant impacts.

Significance Criteria - Criteria identified for specific resources used to determine whether or not impacts would be significant.

Slope - The degree of deviation of a surface from the horizontal.

Slug Tests - A test used to calculate hydraulic conductivity, transmissivity, and the storage coefficient (i.e. the wells potential yield).

Soil Productivity - The capacity of a soil to produce a plant or sequence of plants under a system of management.

Soil Texture - The relative proportions of sand, silt, and clay particles in a mass of soil. Basic textural classes, in order of increasing proportions of fine particles, are: sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, and clay.

Split Estate - A given area where either the surface or mineral estate is Federally owned.

Stipulations - Requirements that are part of the terms of a mineral lease. Some stipulations are standard on all Federal leases. Other stipulations may be applied to the lease at the discretion of the surface management agency to protect valuable surface resources and uses.

Storage Coefficient - The volume of water released from storage in a vertical column of 1 square foot when the water table or other piezometric surface declines one foot.

Structural Trap - One in which entrapment results from folding, faulting, or a combination of both.

Sundry Notice - Standard form to notify of or propose change of approved well operations subsequent to an Application for Permit to Drill in accordance with 43 CFR 3162.3-2 .

Sustainability - The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.

Tertiary - The older of the two geologic periods comprising the Cenozoic Era; also the system of strata deposited during that period.

Thermogenic - Of or pertaining to the rise in temperature in a body from reactions in that body, as by oxidation, or the decay of radioactive elements.

Threatened or Endangered Species - Animal or plant species that are listed under the Federal Endangered Species Act of 1973, as amended (federally listed), or under the Colorado or New Mexico Endangered Species Act (state listed).

Threatened Species - Any plant or animal species likely to become endangered within the foreseeable future throughout all or part of its range.

Thrust Fault - A reverse fault that is characterized by a low angle of inclination with reference to a horizontal plane.

Toe-slope - The most distant part of a landslide; the downslope edge of a landslide or slump.

Total Dissolved Solids - A term that describes the quantity of dissolved material in a sample of material.

Total Suspended Particulates (TSP) - All particulate matter less than approximately 70 micrometers (microns) in effective diameter.

Total Suspended Solids - A term that describes the quantity of solid material in a sample of material.

Transmissivity - The rate at which water is transmitted through a unit width of aquifer under a hydraulic gradient.

Trap - A body of reservoir rock completely surrounded by impervious rock; a closed reservoir.

Turbolator - A type of centralizer that induces turbulent flow for better drilling mud displacement and cement sheath placement.

Unionized Ammonia - A species of nitrogen that is toxic to aquatic life.

Vegetation Type - A plant community with distinguishable characteristics described by the dominant vegetation present.

Vent - An opening in a vessel, fine, or pump to permit the escape of air or gas.

View - Something that is looked toward or kept in sight, especially a broad landscape panorama. Act of looking toward this object or scene.

Viewshed - Total visible area from a single observer position, or the total visible area from multiple observer positions. Viewsheds are accumulated seen-areas from viewer locations. Examples are corridor, feature, or basin viewsheds.

Visual - A mental image attained by sight.

Visual Absorption Capability - The relative ability of a landscape to accept management practices without affecting its visual characteristic. The capability to absorb visual change. A prediction of how difficult it will be for a landscape to meet recommended VQOs.

Visual Quality Objectives - Descriptions of a different degree of alteration of the natural landscape based upon the importance of aesthetics.

Visual Resource Management Class (VRM Class) - The degree of visual change acceptable within the existing characteristic landscape. An area's classification is based upon the physical and sociological characteristics of any given homogeneous area and serves as a management objective.

Walking Beam Pumping Unit - A unit consisting of a pump jack and engine that is used to lift the produced stream (water and natural gas) from the production zone, allowing gas to flow by reducing the hydrostatic pressure on top of a rock unit (i.e., coals).

Well Logging - A logging truck equipped with various electronic logging tools and a computer that goes out to a well site after drilling operations are completed. The data from the logging tools are recorded on film and stored digitally in the on-site computer. The logging engineer generates printed well logs for use in analyzing the stratigraphic units traversed by a borehole.

Wellbore - The hole made by the drilling bit.

Wellhead - The equipment used to maintain surface control of a well. It is formed of the casing head, tubing head, and Christmas tree. Also refers to various parameters as they exist at the wellhead, such as wellhead pressure, wellhead price of oil, etc.

Wetlands – Those areas that are inundated by surface or ground water with a frequency sufficient, under normal circumstances, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth or reproduction. Wetlands include marshes, bogs, sloughs, potholes, river flows, mud flats, wet meadows, seeps, and springs.

Wildcat Well – An exploratory well drilled in an are where there is no oil or gas production (see exploration well).

Wilderness Study Area (WSA) - A roadless area or island that has been inventoried and found to have wilderness characteristics as described In Section 603 of the Federal Land Policy and Management Act and Section 2(c) of the Wilderness Act of 1964 (78 Stat. 891).

Work Force - The total number of workers on a specific project or group of projects. The work force also is referred to as direct employment and primary employment.

APPENDICES

APPENDIX A
JURISDICTION OVER ENERGY RESOURCE DEVELOPMENT ON THE SOUTHERN UTE INDIAN RESERVATION

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by: Thomas H. Shipps[1]

INTRODUCTION

The coordinated undertaking of the Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), and Southern Ute Indian Tribe (SUIT) to prepare a comprehensive study of environmental impacts associated with tribal energy mineral development poses numerous challenges, not the least of which is mastering the complex jurisdictional principles at work on the Reservation. Some aspects of the Southern Ute jurisdictional maze are associated with developments in Indian law that are national in scope. Others derive from the unique history of the SUIT people and their reservation. A snapshot of the jurisdictional roles of federal, tribal, state and local governmental entities in relation to energy resource development on the Reservation may be helpful to those reviewing this document; however, debate or disagreement may accompany opinions about the precise limits of their governmental authority. While neither exhaustive nor definitive, this appendix is intended as a guide to those seeking a greater understanding of the jurisdictional aspects of federal development of reservation land and resources.

THE FEDERAL TRUST RESPONSIBILITY

Because of the pervasive role of the federal government in Indian affairs, a discussion of jurisdiction must include consideration of the federal trust responsibility. From the inception of the United States, the relationship between Indians and non-Indians has been a distinctly federal, rather than a state, governmental matter.[2] The United States Constitution vests in the national government exclusive regulatory authority over commerce with Indian tribes.[3] Judicial decisions construing that authority, as well as subsequent congressional enactments, have recognized a correlative federal duty of protection of Indian tribes, the "federal trust responsibility." Thus, it is legally well established

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[2] *See Worcester v. Georgia,* 31 U.S. (6 Pet.) 515, 561 (1832).

[3] *U.S. Const. art. I, § 8, cl. 3.*

that Indian tribes, in exchange for ceding vast territories and relinquishing their inherent powers of war and foreign diplomacy, secured federal governmental protection of tribal lands, much of which is legally held in trust by the United States for the benefit of specific tribes.[4] Additionally, as quasi-sovereigns, tribes continue to possess the power to control their internal affairs, subject only to ultimate defeasance by Congress.[5]

Federal protection of tribal lands and the laws and regulations implementing that protection directly affect the manner in which tribal energy resources may be developed. Statutes initially enacted as far back as the 1790s continue to render void any sale or lease of tribal land, unless accomplished pursuant to treaty or congressional act.[6] The Indian Mineral Leasing Act of 1938[7] and Indian Mineral Development Act of 1982[8] are two key statutes authorizing the leasing and development of tribal mineral resources. Under both of these acts, Congress requires tribal consent as a condition to the leasing of tribal lands. Under the earlier act, standard form leases written by the Department of the Interior were utilized in conjunction with an auction or bonus bid process in which interested industry representatives could compete for tribal mineral lease acreage. Under the Indian Mineral Development Act of 1982, tribes are encouraged to negotiate directly with industry companies. The customized minerals agreements generated by tribes under that act include everything from complex joint venture arrangements between companies and tribes to simple, negotiated leases similar to those authorized under the 1938 act.

In addition to tribal leasing statutes, Congress has also authorized the leasing of Indian allotted land.[9] These properties are held under trust patents by the United States or restricted patents under United States supervision for the benefit of individual Indians. The allotment process, which was discontinued by Congress in 1934, had been the bulwark of federal Indian policy for almost half a century.[10] It involved the distribution of small parcels of tribal acreage to individual tribal members for agricultural development. The balance of Reservation lands, known as "surplus" land, was then opened for non-Indian homesteading on many reservations.

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[4]See, e.g., County of Oneida v. Oneida Indian Nation, 470 U.S. 226 (1985).

[5] *See generally* Felix S. Cohen, *Handbook of Federal Indian Law 229-257* (2d ed. 1982) ("*Cohen").*

[6] Nonintercourse Act of 1793 (codified as 25 U.S.C. § 177).

[7]25 U.S.C. § § 396a, *et seq.*

[8]25 U.S.C. § § 2101, *et seq.*

[9] *See, e.g.,* Act of March 3, 1909, 35 Stat. 781 (codified as 25 U.S.C. § 396).

[10] *Cohen at 127-143.*

Regardless of the particular statutory scheme, however, administration of Indian mineral leasing and development has been delegated by Congress to the Secretary of the Interior and is subject to a set of comprehensive federal regulations.[11] Approval of leases and land record documents, such as assignments and communitization agreements, is the responsibility of the BIA.[12] The BLM approves well density, underground activities, well operations, and resource measurement.[13] A third Interior agency, the Minerals Management Service (MMS) oversees production, valuation accounting, and auditing.[14] Federal statutes[15], regulations[16], executive orders[17], and case decisions[18] require that tribes be given an opportunity to expand their governmental presence in all phases of Indian mineral development in cooperation with each of these federal agencies. Additionally, in keeping with the principle that tribes retained inherent authority to control their internal affairs unless divested by Congress, tribes have significant supplemental powers related to mineral development, including those of taxation and land use control.[19]

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[11] 25 C.F.R. Parts 211, 212, 225 (1996).

[12] 25 C.F.R. § § 211.20 , 211.29, 225.22, 225.33 (1996).

[13] 25 C.F.R. § 211.3 (citing 43 C.F.R. Parts 3160, 3180, 3260, 3280, 3480 and 3590).

[14] *See* Federal Oil and Gas Royalty Management Act of 1982 , 96 Stat. 2448 (codified as 30 U.S.C. § § 1701, *et seq.*).

[15] *E.g.*, 30 U.S.C. § 1732 (authorizing cooperative audit agreements between MMS and tribes regarding tribal lands); *e.g.*, Indian Self-Determination Act of 1975, Pub. L. No. 93-638 (codified at 25 U.S.C. § § 450f-450n) (permitting tribes to contract to perform Indian program services of the Departments of the Interior and Health and Human Services).

[16] *E.g.*, 25 C.F.R. § 211.29 (authorizing Indian Reorganization Act tribes to enact tribal laws superseding those contained in 25 C.F.R. Part 211).

[17] *E.g.*, United States President, *Memorandum for the Heads of Executive Departments and Agencies* (Apr. 29, 1994); United States Department of the Interior, *Departmental Responsibilities for Indian Trust Resources*, Order No. 3175 (Nov. 8, 1993) (requiring consultation with tribes prior to issuing policy directives affecting tribes and their resources).

[18] *E.g.*, *City of Albuquerque v. Browner*, 97 F.3d 415 (10th Cir. 1996) (recognizing authority of Pueblo of Isleta to promulgate water quality standards applicable to upstream municipality).

[19] *E.g.*, *Merrion v. Jicarilla Apache Tribe*, 455 U.S. 130 (1982).

Thus, the basic structure of Indian mineral leasing and development flows from the power and responsibility of the federal government to protect Indian lands and to take such action as serves the best interests of Indian constituents. Tribes are encouraged to assume an increasing role in the day-to-day and long-range management of their own resources. In that regard, over the last decade, the SUIT has taken major steps to manage development of its energy resources in cooperation with its federal trustee.

THE SOUTHERN UTE INDIAN RESERVATION

The present-day Reservation is a remnant of a much larger territory: approximately the western third of the state of Colorado, which was set aside for the confederated Ute bands in 1868.[20] Expanding western settlement throughout the late nineteenth and early twentieth centuries, coupled with ever-changing federal Indian policies, resulted in the substantially reduced current Reservation.[21] By federal statute, all lands within the boundaries of an Indian reservation, regardless of ownership, are deemed to be part of "Indian Country,"[22] the territory within which Indian tribes may exercise certain governmental powers.[23] Determining the boundaries of reservations and of "Indian Country," however, can be extremely difficult.[24] Particularly on reservations that have undergone allotment and homesteading, ascertaining reservation boundaries often involves major, complex litigation.[25]

Because the Reservation was one of many Indian reservations subject to allotment and homesteading, uncertainty as to its boundaries persisted until Congress enacted legislation on the subject in 1984.[26] Public Law No. 98-290 reflected a consensual resolution of boundary and jurisdiction issues among the SUIT, State of Colorado, Archuleta and La Plata counties, Town of Ignacio, and the United States government. That legislation confirmed exterior Reservation

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[20] Treaty with the Ute Indians, 15 Stat. 619 (1868).

[21] *See* Act of May 21, 1984, Pub. L. No. 98-290, *reprinted in* 25 U.S.C.S. §668 historical note (confirming exterior boundaries of the Southern Ute Indian Reservation) ("P.L. 98-290").

[22] 18 U.S.C. § 1151.

[23] *See, e.g., Oklahoma Tax Commission v. Sac and Fox Nation,* 508 U.S. ____, 124 L.Ed 2d 30, 39-41 (1993).

[24] *See, e.g., Hagen v. Utah,* 510 U.S. ____, 127 L.Ed 2d 252 (1994).

[25] *See, e.g., Solem v. Bartlett,* 465 U.S. 463 (1984); *Rosebud Sioux Tribe v. Kneip*, 430 U.S. 584 (1977); *Mattz v. Arnett,* 412 U.S. 481 (1973); *Seymour v. Superintendent,* 368 U.S. 351 (1962).

[26] Act of May 21, 1984, Pub. L. No. 98-290, *reprinted in* 25 U.S.C.S. § 668 historical note.

boundaries based on various treaties and statutes and established an "Indian Country" land area of approximately 700,000 acres, including tribal trust lands, Indian allotments, homesteaded fee tracts, Bureau of Reclamation lands, and National Forest lands. The SUIT currently owns approximately 300,000 acres of the surface estates within the Reservation. This patchwork pattern of land ownerships is typical of "checkerboard" reservations opened for homesteading in the West.

The checkerboard of land ownerships, however, is not limited to surface lands. The varied ownership of severed mineral and surface estates creates a multidimensional situation that can be understood only by reviewing some Reservation history.[27] Following the completion of individual Indian allotment in 1899, non-Indian homesteading took place over the next approximately 35 years. National attitudes about conservation of mineral resources also evolved during that period, as reflected in a series of homestead laws that reserved different mineral estates to the federal government. For example, under the homestead laws of 1909 and 1910, coal estates on federally designated coal lands were reserved from agricultural homestead patents.[28] Substantial portions of the Reservation were so designated. In 1916, Congress enacted the Stock-Grazing Homestead Act, which reserved all minerals, including coal and oil and gas estates from homestead patents.[29] By 1934, substantial homesteading under various laws had taken place within the Reservation along the La Plata, Animas, Florida, and Pine river drainages, as well as Florida Mesa; however, several hundred thousand acres of surplus land remained unpatented.

Passage of the Indian Reorganization Act of 1934 signaled a major shift in federal Indian policy and also provided a mechanism for tribes, such as the SUIT, to resume control of their surplus lands.[30] Under that act, those tribes that adopted written constitutional forms of government in federally supervised elections were entitled to restoration of all undisposed of surplus lands still left in the wake of allotment and homesteading. In 1936, the SUIT adopted its first written constitution, and by Presidential Order issued in 1938, the United States restored to tribal trust ownership all unpatented lands and estates within the Reservation.[31]

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[27] For more detailed historical background the following sources are instructive: *Southern Ute Indian Tribe v. Amoco Production Co.*, 863 F. Supp. 1389, 1394-1399 (D. Colo. 1994), *appeal filed*, Case No. 94-1579 (Dec. 9, 1994, 10th Cir.); *Confederated Band of Ute Indians v. United States*, 100 Ct. Cl. 413 (1943); *Restoration to Tribal Ownership-Ute Lands*, I Dept. Of Interior, Op. Solicitor 832 (June 15, 1938).

[28] Act of March 3, 1909, 35 Stat. 844 (codified at 30 U.S.C. § 81); Act of June 22, 1910, 36 Stat. 583 (codified at 30 U.S.C. § § 83-85).

[29] Act of December 29, 1916, 39 Stat. 862 (codified at 43 U.S.C. § § 291-299).

[30] 48 Stat. 984 (codified at 25 U.S.C. § § 461 *et seq.*).

[31] Order of Restoration, 3 Fed. Reg. 1425 (Sept. 14, 1938).

Restoration to the SUIT under the Indian Reorganization Act included approximately 300,000 acres of land involving both surface and mineral estates (fully undisposed surplus lands); the complete severed mineral estates underlying approximately 100,000 additional acres of land (surface estates patented to non-Indians under the Stock-Grazing Homestead Act of 1916); and the severed coal estates underlying approximately 200,000 additional acres of land (agricultural surface patents issued to non-Indians under the Coal Land Entry Acts of 1909 and 1910). Thus, today, the Reservation checkerboard remains three dimensional.

The land ownership pattern within the Reservation boundaries confirmed in 1984 by Public Law No. 98-290 has been and continues to be a source of jurisdictional confusion. In that legislation, however, Congress addressed several jurisdictional issues in a manner supported by affected governmental entities. As reflected in the language and legislative history of the statute, tribal territorial jurisdiction over non-Indians within the reservation was limited to Indian lands. Federal jurisdiction over non-Indians under Indian Country laws was similarly confined to Indian lands. These concessions by the SUIT and the federal government eliminated a likely and contentious category of potential jurisdictional disputes by generally ensuring that the SUIT would not regulate the activities of non-Indians undertaken on their own lands within the Reservation. Conversely, the SUIT and the federal government retained full Indian Country jurisdiction over Indians everywhere within the boundaries of the Reservation, regardless of the ownership status of such lands. Finally, the act treated incorporated municipalities within the Reservation, such as the Town of Ignacio, as islands in which municipal and tribal governments could exercise concurrent criminal jurisdiction over tribal members. While the clarifications contained in P.L. 98-290 provided congressional direction in several key areas, subsequent efforts to apply the legislation to lands involving split estates or to environmental protection programs have proven difficult.

The most exacting review of P.L. 98-290 to date has been provided in the context of environmental litigation. In the case of *Lyon v. Amoco Production Company*,[32] a group of landowners sued seven energy companies for monetary and equitable relief for water well contamination allegedly caused by regional oil and gas development. The Court of Appeals upheld the lower court's dismissal of the case on jurisdictional grounds. Specifically, the court found that most of the development in the region took place within Indian Country as defined by P.L. 98-290, and most of the company wells were drilled on tribal mineral lands pursuant to federally approved leases. While recognizing that the parties to the case were non-Indians, the court concluded that, because the allegedly wrongful conduct commenced on tribal land and because the economic and political integrity of the SUIT was principally involved, state courts lacked authority to proceed with the case. The *Lyon* case amply demonstrates the jurisdictional tension that can arise in the midst of conflicting interests within the Reservation boundaries.

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[32] 923 P.2d 350 (Colo. App.), *cert. withdrawn* 20 Colo. J. V (Colo. App. 1996).

JURISDICTION OVER RESERVATION ENERGY DEVELOPMENT

To some extent federal, Tribal, state, and local governments each have a role in regulating on-Reservation energy development. Mineral development generally involves a series of steps including leasing by the mineral owner to a mineral development company; permitting and drilling of wells; installation of gathering and treating facilities; ongoing production-related activities; and reclamation. The precise role of each government turns not only upon the proposed activity at issue, but also upon the party undertaking the activity; the location of the activity; and the purpose and relative governmental importance of the activity. Application of these factors is most easily illustrated by hypothetical.

Assume that Mary Mayflower, a non-Indian, owns a tract of land originally homesteaded by her grandparents on the Reservation in 1906. Under the homestead laws then in place, her grandparents received a fee simple absolute patent that included all surface and mineral rights to the property. Mary has been approached by Wellbore Oil Company, a non-Indian-owned independent company, which has proposed to lease her oil and gas minerals and to drill a well on her back forty. No governmental entity at this point has a direct role in deciding whether Mary issues a lease. Let's further assume that Mary Mayflower issues a lease to Wellbore Oil Company. Before Wellbore may proceed with well-drilling, state law requires Wellbore to obtain a well permit. Such a permit would not be issued unless the location of Wellbore's well conforms to fieldwide spacing rules issued by the Colorado Oil and Gas Conservation Commission establishing the pattern and density of well locations. Assuming that Wellbore's well is successful, Wellbore may wish to construct its regional headquarters on Mary's property under the terms of a separate surface lease. Wellbore would need to obtain appropriate approval from the local county officials with respect to construction of such a facility. In the Mary Mayflower hypothetical, there is no direct Tribal or federal role; however, that is easily changed.

Assume that Mary Mayflower's grandparents homesteaded in 1926, instead of 1906. Under the homestead laws then in place, the United States reserved all minerals from the Mayflower patent. In 1938, those reserved minerals were restored to trust ownership for the benefit of the SUIT. Wellbore Oil Company, a non-Indian-owned independent company, has approached the Tribal Council with a joint-venture proposal under the Indian Mineral Development Act of 1982 and has suggested that the SUIT and Wellbore split the cost of drilling a well into the Tribal minerals underlying Mary's back forty. If the SUIT accepts the Wellbore joint venture proposal, the proposal is invalid unless it is reduced to writing and approved by the BIA. Should such approval be obtained, Wellbore must obtain a well permit from the BLM. Although the BLM may consider the spacing rules of the Colorado Oil and Gas Conservation Commission, issuance of the permit is not conditioned upon compliance with those rules. Rather, the BLM's permit decision must be guided by the best interests of the SUIT. While Mary, who opposed the drilling of a well on her property, may have certain federal administrative appellate rights to challenge the BLM permit decision, it is unlikely that such a decision would be reversed.

Further, assume that Mary issued a surface lease to the SUIT so that the SUIT could build a small well supply store on her property. In that instance, the SUIT would not be required to obtain a county land use permit because the SUIT has the right to regulate its own affairs to the exclusion of the state or local government within Indian Country.

The foregoing hypothetical situations illustrate how ultimate determinations of jurisdiction are affected by variables, such as the status of the actor, the ownership and location of the affected land, and the purpose of the activity. While many situations present greater complexities than those reflected in the hypothetical situations, the hypothetical situations should indicate the potential for disagreement between affected individuals and governmental entities about resource development within the Reservation. In the interest of minimizing conflicts, the federal government, the SUIT, and state and local governments have recognized the value of cooperative, though not necessarily joint, decision-making. For example, the BLM, BIA, SUIT, and Colorado Oil and Gas Conservation Commission have entered into agreements intended to facilitate communication and governmental cooperation with respect to on-Reservation well density and spacing.[33]

ENVIRONMENTAL RESOURCE PROTECTION

Mineral development on tribal and non-tribal lands within the Reservation commenced in approximately 1950, and since that time, companies have drilled thousands of gas wells in the northern San Juan Basin. Since the 1950s, heightened sensitivity to unnecessary environmental degradation has resulted in a number of major laws which impact the manner in which tribal mineral development is conducted. Perhaps the most significant of these laws is the National Environmental Policy Act[34] (NEPA). Under NEPA, before taking any major federal action that might significantly affect the quality of the human environment, a federal agency must conduct a thorough analysis of the alternatives and effects of that action and compile its study in a written statement that can be submitted to and commented upon by the public. Because of the pervasive federal regulatory role associated with Indian mineral resource development, federal agencies, such as the BIA and the BLM, are regularly called upon to take action with respect to that mineral development. In conducting an initial environmental assessment of particular decisions related to Indian mineral development, such agencies may conclude that a specific decision does not have a significant impact on the environment. If, however, the agency concludes that significant impacts may result from a specific decision or from the cumulative effect of numerous similar decisions, then it must perform

[33] Memorandum of Understanding between Southern Ute Indian Tribe and Bureau of Land Management and Interagency Agreement between Bureau of Indian Affairs and Bureau of Land Management (Aug. 22, 1991); Memorandum of Understanding between the Colorado Bureau of Land Management and the Colorado Oil and Gas Conservation Commission (Aug. 22, 1991).

[34] Act of January 1, 1970, Pub. L. No. 91-190 (codified at 42 U.S.C. § § 4321, *et seq.).*

the detailed analysis and complete the environmental impact statement process. Only if the action agency concludes that the proposed action is reasonable when measured against the studied alternatives, may the action proceed. [35]

Aside from the normal considerations of federal agencies in applying NEPA or other environmental statutes, the trust responsibility imposes special concerns when applying those laws to Indian Country. So long as not in violation of applicable federal law, federal agencies are required to act reasonably and prudently in furthering the best interests of tribes and to consult with tribes in ascertaining tribal best interests.[36] As stated in a leading case on this subject, a federal official "cannot escape his role as trustee by donning the mantle of administrator."[37] In some cases, Congress has even required that federal agencies comply with tribal law in the course of managing tribal natural resources.[38] Thus, if a federal agency is confronted with two lawful courses of action--one of which would further tribal best interests, and the other of which would be preferable from a policy or administrative standpoint to the agency administrators--the trust responsibility requires that the federal agency take the action that furthers tribal best interests. This aspect of the federal trust responsibility not only adds tension to the already difficult duties of many federal officials, but also is the reason why a decision affecting Indian land might be different from that reached in a similar setting involving public land. In the public land situation, the best interests of a single constituent group does not legally dictate a result, and implementation of then-current policy may be paramount to the desires of any particular special interest.

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[35] In determining the reasonableness of activity on tribal land that involves an environmentally significant federal decision, the action agency arguably must weigh heavily the importance of the proposed activity to the tribe in order to comply with federal trust responsibility.

[36] *See, e.g., Jicarilla Apache Tribe v. Supron Energy Corp.*, 728 F.2d 1555, 1567 (10th Cir. 1984), (Seymour, J. concurring in part, dissenting in part), *aff'd in part, rev'd in part,* 782 F.2d 855 (10th Cir.), *modified*, 793 F.2d 1171 (10th Cir.) (adopting concurring dissent of Seymour, J. In 728 F.2d 1555), *cert. denied, sub nom. Southern Union Co. v. Jicarilla Apach Tribe,* 479 U.S. 978 (1986).

[37] *Id.*

[38] The National Indian Forest Resources Management Act of 1990, Title III, § 309 (codified at 25 U.S.C. § 3108); American Indian Agricultural Resource Management Act of 1993, Title I, § 102 (codified at 25 U.S.C. § 3712).

In addition to NEPA, development of tribal mineral resources is conducted in accordance other national environmental legislation, such as the Endangered Species Act[39], Clean Air Act[40], Clean Water Act[41], and Safe Drinking Water Act.[42] Amendments to the Clean Air Act, Clean Water Act, and Safe Drinking Water Act,[43] passed by Congress since enactment of Public Law No. 98-290 in 1984, are intended to permit Indian tribes to assume primary programmatic and enforcement authority from the Environmental Protection Agency (EPA) with respect to Indian reservations. The actual transfer of authority from the EPA to tribes requires that the EPA review and approve the capacity of tribes to carry out the purposes of the environmental programs within their reservations. In this regard, EPA has a strong preference, if not a requirement, that an applying tribe possess regulatory jurisdiction over all persons throughout the boundaries of a reservation. Understandably, EPA has concluded that administration of environmental protection programs is less effective when undertaken on a checkerboarded basis than when conducted on a regional or reservation-wide basis.

Under authority of the Clean Water Act amendments, the SUIT has adopted reservation-wide water quality standards and has applied to EPA for delegation under the "treatment as a state" regulations for recognition of those water quality standards. EPA is aware of Public Law No. 98-290 and is currently reviewing the jurisdictional authority of the SUIT to adopt such standards in light of the amendments to the Clean Water Act. While there seems little question under Public Law No. 98-290 that the SUIT has authority to adopt Reservation-wide standards applicable to Indians, the EPA has not yet concluded whether the Clean Water Act amendments supersede the Public Law No. 98-290 tribal jurisdictional limitations with respect to non-Indians conducting activities on non-Indian lands within the Reservation. Thus, it is not clear if the SUIT will assume Reservation-wide primacy over environmental programs the EPA may delegate or whether EPA will retain principle jurisdiction over such programs. To the extent that such environmental programs apply to energy development activities, the answer to the EPA delegation question will be significant in determining the governmental entity with primary jurisdiction.

CONCLUSION

The concept of jurisdiction on the Reservation, as on other Indian reservations, is necessarily complex. Specific legislation related to the SUIT answers basic questions about Reservation

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[39] 16 U.S.C. § § 1531, *et seq.*

[40] 42 U.S.C. § § 7401, *et seq.*

[41] 33 U.S. C. § § 1251, *et seq.*

[42] 42 U.S.C. § § 300f-300j-12.

[43] 42 U.S.C § 7601 (d) (Air); 33 U.S.C. § 1377 (Water); 42 U.S.C. § 300j-11 (Safe Water).

boundaries and Indian Country. Other aspects of that legislation, however, make it difficult to identify which governmental entity has jurisdiction over a proposed energy related activity without considering a variety of factors. Only after reviewing such variables and the relative interests of the federal, state, tribal or local governments, can one reach a conclusion about ultimate jurisdiction. In order to avoid needless litigation on such points, however, those governments have embarked to some extent on a course of cooperation and discussion, in which the relative concerns of each government can be aired. Perhaps as such dialogue continues, additional clarity can be provided through more intergovernmental agreements or congressional legislation.

boundaries and Indian Country. Other aspects of that legislation, however, make it difficult to identify which governmental entity has jurisdiction over a proposed energy-related activity without considering a variety of factors. Only after reviewing such variables and the relative interests of the federal, state, tribal or local governments, can one reach a conclusion about ultimate jurisdiction. In order to avoid needless litigation over such points, however, those governments have embarked to some extent on a course of cooperation and discussion, in which the relative concerns of each government can be aired. Perhaps as such dialogue continues, additional clarity can be provided through more intergovernmental agreements or compacts.

[illegible] capacity of tribes [illegible] In this regard, EPA has a strong preference [illegible] that an applying tribe possess regulatory jurisdiction [illegible] boundaries of a reservation. Understandably, EPA has concluded that [illegible] programs is less effective when [illegible] on a regional or reservation-wide basis.

Under authority of the Clean Water Act [illegible] has adopted reservation-wide water quality standards and has [illegible] EPA [illegible] "treatment as a state" regulations for [illegible] water quality standards. [illegible] Public Law No. 98-290 and is currently [illegible] to adopt such standards in light of the amendments to the Clean Water Act. [illegible] under Public Law No. 98-290 that the SUIT [illegible] applicable to Indians, the EPA has not yet concluded whether the Clean Water Act [illegible] supersede the Public Law No. 98-290 tribal jurisdictional limitations [illegible] activities on non-Indian lands within the Reservation. Thus, [illegible] Reservation-wide primacy over environmental programs the EPA may [illegible] EPA will retain principle jurisdiction over such programs. To the extent that [illegible] programs apply to energy development activities, the answer to the EPA [illegible] will be significant in determining the governmental entity with primary jurisdiction.

CONCLUSION

The concept of jurisdiction on the Reservation, as on other Indian reservations, is necessarily complex. Specific legislation related to the SUIT [illegible] questions about Reservation

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[illegible] 16 U.S.C. § § 1531, et seq.

[illegible] 42 U.S.C. § § 7401, et seq.

[illegible] 33 U.S.C. § § 1251, et seq.

[illegible] 42 U.S.C. § § 300f-300j-11.

[illegible] 40 C.F.R. § 7501 (d) (A)(i); 33 U.S.C. § 1377 ([illegible] Water); 42 U.S.C. § 300j-11 (Safe Water).

APPENDIX B
AUTHORITY AND RESPONSIBILITY FOR ENERGY AND RESOURCE OPERATIONS

APPENDIX B
AUTHORITY AND RESPONSIBILITY FOR ENERGY RESOURCE OPERATIONS

The Bureau of Indian Affairs (BIA) and Bureau of Land Management (BLM) have federal responsibility for environmental protection, public health and safety, and operation and production oversight related to mineral leasing and development on Indian lands ("tribal minerals). There are four principal pieces of legislation that give primary direction to the BIA and BLM for these operations: the Allotted Lands Leasing Act of March 3, 1909; Indian Mineral Leasing Act of May 11, 1938 (Tribal); 1982 Indian Mineral Development Act (IMDA); and National Environmental Policy Act (NEPA) of 1969. In addition, the federal government has a special trust or fiduciary responsibility to the Indian people when considering actions which will impact tribal resources and interests. Other legislation, most notably laws to protect cultural resources and endangered species, also affect various aspects of energy resource development. Table B-1 lists the major federal, state, and county authorizing actions that pertain to this project.

NEPA directs all federal agencies to analyze and disclose to the public the impacts of federal actions. The Southern Ute Indian Tribe (SUIT), BIA, and BLM are preparing this environmental impact statement (EIS) to fulfill the mandate of NEPA.

Persons or companies may obtain rights to explore and develop tribal minerals, either by a traditional lease agreement or through geophysical exploration. Under the traditional lease agreement for tribal and allotted lands under the 1909 and 1938 acts, an application to lease lands may be submitted to the BIA. Leases are awarded through a sale process to the highest competitive bidder. Lessees pay a rental of $1.25 per acre per annum that may be credited to the royalty, which is a minimum of 12½ percent of the value or amount of production. Most leases on the Southern Ute Indian Reservation (Reservation) have a royalty of 16⅔ percent. The primary term of a lease is 10 years and may continue in effect as long as there is production in paying quantities. Rents and royalties accruing from the lease are returned to the SUIT or allottee.

Most recent grants of exploration and development rights on the Reservation have been issued under the IMDA, under which a mineral agreement is negotiated between the operator and the SUIT and then approved by the BIA. BLM also provides technical input on operational matters. An individual Indian allottee may include their mineral resources in an agreement subject to concurrence of the parties and approval of the Secretary of the Interior. The purpose of the IMDA is to provide tribes with more responsibility and flexibility to maximize their best economic interest and minimize adverse environmental or cultural impact. All terms of a mineral agreement (term, royalty, performance clauses, etc.) are negotiable. As with leases, proceeds from the agreement are returned to the SUIT or allottee. Although a minerals agreement may be more elaborate than a standard lease, it is often loosely referred to as a lease and is treated as a lease for the purposes of permitting operations and conducting compliance inspections.

TABLE B-1
MAJOR FEDERAL, STATE, AND COUNTY AUTHORIZING ACTIONS[1]

Agency and Permit/Approval	Nature of Action	Authority	Application
FEDERAL PERMITS, APPROVALS AND AUTHORIZING ACTIONS			
Bureau of Land Management			
Decision Record for Preferred Alternative	Evaluate environmental impacts of Preferred Alternative.	National Environmental Policy Act of 1969, 42 USC 4321 *et seq.* Council on Environmental Quality, 40 CFR 1501, 1502	Preferred Alternative
Permit to Drill, Deepen, or Plug Back (APD)	Provide for compliance with regulations and requirements during the drilling and completion phase of the well.	Mineral Leasing Act of 1920 (30 USC 181 et seq.), 43 CFR 3160; Federal Oil and Gas Royalty Management Act of 1982, 43 CFR Part 3160 series, subparts 3160.0-1 Purpose, 3160.0-1 Authority, and 3161.1 Jurisdiction; Secretarial Order No. 3087, Amendment No. 1, February 7, 1983; Indian Mineral Development Act of 1982, 43 CFR, Part 3160.0-3	Nitrogen injection wells and gas production wells
U.S. Bureau of Indian Affairs			
Approval of Unitization	Provide for efficient and timely development and production of Tribal oil and gas leases.	Indian Minerals Leasing Act of May 11, 1938, 25 USC 396a-396q, 25 CFR, Part 211; Act of March 3, 1909, 25 USC 396, 25 CFR, Part 212; Indian Mineral Development Act of December 22, 1982, 25 USC 2102-2108, 25 CFR Part 225	Unit area
Rights-of-Way	Grant rights-of-way and issue temporary permits.	Act of March 3, 1901, c.832 ss4.31.Stat.108; 209DM8 Secretaries Order 3150 and 3177, as amended, 10 BIAM, bulletin 13, as amended, and Albuquerque Area Addendum Release 9401	Pipelines, roads

TABLE B-1
MAJOR FEDERAL, STATE, AND COUNTY AUTHORIZING ACTIONS[1]

Agency and Permit/Approval	Nature of Action	Authority	Application
Archaeological Clearance	Issue antiquities or archaeological resource permits to remove or excavate archaeological resources on land administered by BIA.	Antiquities Act of 1906, 16 USC Secs. 431-433; Archaeological Resources Protection Act of 1979 (16 USC Secs. 470a-47011), 43 CFR, Parts 3 and 7; National Historic Preservation Act, Section 106 and 36 CFR Part 800	All Preferred Alternative components
U.S. Army Corps of Engineers			
Section 404 Permit	Issue a permit for placement of fill or dredged material in waters of the United States or their adjacent wetlands.	Sec. 404, Clean Water Act, 40 CFR Parts 122-123; 33 USC Sec. 1344; 33 CFR, Parts 323 and 325	Pipelines
U.S. Fish and Wildlife Service			
Consultation Process, Endangered or Threatened Species	Review of impact on federally listed and candidate threatened and endangered fish, wildlife, and plant species.	Sec. 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. Sec 1344), 33 CFR Parts 323 and 325	See Appendix A. All Preferred Alternative surface-disturbing activities
U.S. Environmental Protection Agency			
Produced-Water Disposal	Issue a permit to allow for underground injection of produced water.	Safe Drinking Water Act (42 USC 300F-300-9), 40 CFR Parts 144 and 147	Underground injection control
Permit for Underground Injection Control	Regulate underground injection of nitrogen.	CRS 1973, 34-60-106(2)(d) and 34-60-106(9)	Underground injection control wells
TRIBAL PERMITS, APPROVALS, AND AUTHORIZING ACTIONS			
Southern Ute Indian Tribe			
Approval of Unitization	Provide for efficient and timely development and production of Tribal oil and gas leases.	Indian Minerals Leasing Act of May 11, 1938, 25 USC 396a-396q, 25 C.F.R., Part 211; Act of March 3, 1909, 25 USC 396, 25 CFR, Part 212; Indian Mineral Development Act of December 22, 1982, 25 USC 2102-2108, 25 CFR Part 225	Unit area

TABLE B-1
MAJOR FEDERAL, STATE, AND COUNTY AUTHORIZING ACTIONS[1]

Agency and Permit/Approval	Nature of Action	Authority	Application
Rights-of-Way and Permits to Drill	Approve rights-of-way, temporary permits, and permits to drill.	Act of March 3, 1901, c.832 ss4.31.Stat.1084; 209DM8 Secretaries Order 3150 and 3177, as amended, 10 BIAM, Bulletin 13, as amended, and Albuquerque Area Addendum Release 9401	Pipeline, facility, and well locations
Air emissions inventory data[2]	Accumulating emissions data.	Clean Air Act.	All air pollutant emission sources
STATE PERMITS, APPROVALS AND AUTHORIZING ACTIONS			
Colorado State Historic Preservation Office			
Archaeological Clearance	Programmatic agreement and/or consultation for cultural resource inventory, evaluation, and mitigation.	National Historic Preservation Act, Section 106 and 36 CFR Part 800	Pipeline and unit area
Colorado Department of Public Health and Environment			
Air Pollutant Emissions Permit	Issue an air pollutant emissions permit which limits emissions from new or modified sources.	CRS 25-7-112; 5 CCR 1001-5	All air pollutant emission sources.
Colorado Department of Highways			
Transport Permit	Issue a permit for oversize, over-length and overweight loads.	CRS 42-4-409; 2 CCR 602-4	Transportation of equipment and materials on state roads
Utility Permit	Issue a permit for right-of-way easement crossing state highways.	CRS - 43-1-105	Pipeline highway crossings
Colorado Department of Natural Resources - Oil and Gas Conservation Commission			
Permit to Drill, Deepen or Re-Enter and Operate an Oil and Gas Well	State approval of drilling on all non-federal lands within the state.	CRS 1973, 34-60-106(2)(d) and 34-60-106(9)	Nitrogen injection wells
Produced-Water Disposal	Issue a permit to allow for underground injection of produced water.	Safe Drinking Water Act (42 USC 300F-300-9), 40 CFR Parts 144 and 147	Underground injection control
Permit for Underground Injection Control	Regulate underground injection of nitrogen.	CRS 1973, 34-60-106(2)(d) and 34-60-106(9)	Underground injection control wells and production wells converted to injection wells

TABLE B-1
MAJOR FEDERAL, STATE, AND COUNTY AUTHORIZING ACTIONS[1]

Agency and Permit/Approval	Nature of Action	Authority	Application
Approval of Unitization	Provide for efficient and timely development and production of non-federal and non-Tribal oil and gas leases.	Cause 112, Order #112-122 issued June 9, 1996	Unit area
Colorado Department of Public Health and Environment			
Stormwater Permits	Regulate discharge of stormwater.	Clean Water Act, 40 CFR Section 401; Colorado Water Quality Control Act 25-8-101, 6.4.2(5)(c)(x)	Pipeline installation
Utility Notification Center of Colorado			
Point of Contact Before Excavating	Advise on existence and locale of underground facilities.	CRS 9-15-103	Pipelines and wells
LOCAL PERMITS, APPROVALS, AND AUTHORIZING ACTIONS			
La Plata County			
Special Use Permit	Issue a permit for surface facilities on private lands not connected with downhole operation.	Land Development Code	All Preferred Alternative components in La Plata County not located on Tribal land
Road Use Permit	Issue a permit to allow for overweight and overlength loads on County roads.	Land Development Code	Transportation of equipment and materials on County roads
Road and Bridge Application for Permit to Work on County Right-of-way	Issue permit for crossing county roads.	Land Development Code	Pipelines

[1] This permit and approval list is not all inclusive. It is the responsibility of the operator to ensure that all permits and approvals are secured before the project may proceed.

2 The Southern Ute Indian Tribe and state of Colorado are cooperatively developing a joint commission through which to manage air quality within the exterior boundaries of the Reservation.

Separate from leasing actions, geophysical explorers may explore for oil and gas on Indian land. Geophysical exploration on Indian land requires approval of the methods employed and mitigation of impacts. The BIA Agency Office must receive a copy of the proposal to perform geophysical operations on the Reservation. The exploration plan is analyzed for conformance with the SUIT's natural resource management plan and existing leases, and mitigative measures and reclamation requirements are attached to the approval. Specialists examine the plan of operations and the site, line, or area to be explored in determining appropriate mitigative measures and reclamation requirements.

The majority of geophysical exploration operations on Indian lands is conducted by exploration companies. Some are associated with petroleum producers; many are not. Geophysical exploration operations also may be conducted on a lease held by the lessee with the same requirements for mitigation of impacts and reclamation.

A well must be drilled in order to produce oil and/or gas from a lease. Before drilling a well on the Reservation, the lessee or an operator for the lessee must file an Application for Permit to Drill (APD). The operator must file the application with the BLM's San Juan Field Office. Copies of the APD are also sent to the SUIT and the BIA Agency Office in Ignacio, Colorado. The application must include a drilling plan and a surface use plan. The drilling plan contains information as to the depth of the well, how it will be constructed, how groundwater and other mineral resources will be protected, and how blow-outs and other emergencies will be prevented or handled. The surface use plan addresses such concerns as the location and amount of surface disturbance and how that disturbance will be reduced or eliminated. It identifies mitigation of impacts on wildlife, cultural resources, vegetation, soil, surface water, and other land uses and values. The operator is responsible for setting forth its plans for addressing these matters in the proposed APD. If the APD does not have the appropriate information and mitigation incorporated, the application may be modified or rejected. In approving an APD, BLM may impose requirements related to these issues as Conditions of Approval (COAs).

At a minimum, each APD is reviewed by a BLM geologist, petroleum engineer, and surface reclamation specialist; a BIA realty/minerals specialist; tribal minerals and surface reclamation personnel; and the management for the agencies and the SUIT. The geologist evaluates the need for groundwater and other mineral resource protection and the structural competency of casing point formations. The petroleum engineer evaluates the drilling plan, well construction, and safety of the operation. The surface reclamation specialist evaluates the surface plan, checks the proposal against other guidance, conducts the on-site inspection, analyzes impacts, proposes mitigation, and writes the environmental assessment (EA). The surface reclamation specialist also calls upon other expertise as needed in the analysis of impacts and recommendation of mitigation and reclamation requirements. For example, an archaeologist would recommend any needed mitigation for impacts on cultural resources.

Each lease where an APD is proposed is checked to see if a bond has been posted to cover abandonment of the well should the lessee/operator default on their obligations under the lease. Each application is evaluated as described above, and subjected to a field inspection of all proposed disturbed areas. Appropriate site-specific mitigation is then attached to the APD as COAs. A cultural resource inventory is conducted for each APD. In designated areas, endangered species or other inventories may be conducted. The proposal is subjected to NEPA review (an EA) that checks for conformance and determines whether or not there is a need for additional review (i.e., an expanded EA or EIS). EAs are prepared for all APDs on Indian lands. When all impacts are analyzed and all necessary mitigation incorporated, the APD may be approved. The BLM will not approve an APD without the appropriate concurrences from the SUIT and BIA, who may also attach COAs (see Appendix E).

In cases where the proposed well is obviously part of a larger field development and such development has not already been evaluated by another NEPA document, a "field development" EA is prepared. This EA evaluates conformance of the specific field development with the general development previously analyzed. If the projected field development does not substantially conform or is considerably outside the scope of previous analysis, an expanded EA or possibly an EIS may need to be prepared.

Over the life of a field, other operations, such as construction of power lines, pipelines, use of secondary and tertiary recovery methods, and other production facilities may become necessary. These projects may be approved under right-of-way by BIA or under Sundry Notice by BLM depending on whether the action is occurring on or off the lease and the lease interest is held by the operator. Each new surface disturbance is subjected to the same test. Each is analyzed to determine impacts and mitigation. New ideas and technology are incorporated into new mitigative measures as they become available and when they do not impact the lease rights granted. New ideas and technology may also require amendment or maintenance of the EIS prior to use as mitigation.

As a well reaches its economic limit, it is abandoned and the disturbed area reclaimed. The operator must submit an abandonment notice for approval. The notice is evaluated by a BLM petroleum engineer to determine that the well will be plugged so as to protect freshwater zones, other mineral resources, and the surface from contamination by any oil or gas that might leak up from the depleted reservoir or other fluids and gases up hole or on the surface that could migrate through the old well bore (and casing if left in place). The surface reclamation specialist for the SUIT and BIA checks the final reclamation proposal to ensure it is in accordance with the original APD requirements, and, in some cases, incorporates the latest methods of reclamation. Reclamation is required to restore the well site, road and other disturbances to as original (or better) a condition as reasonably possible. The SUIT surface reclamation specialist also inspects the location once or twice at approximately one-year intervals to monitor the progress of reclamation. If the reclamation does not meet the requirement set out in the APD, the operator will revegetate those portions necessary to complete the goals for the reclaimed area. The well site will continue to be monitored until the SUIT surface reclamation specialist is satisfied that the reclamation has succeeded and the location is stable.

Field operations are inspected by various personnel from the SUIT, BIA, and BLM to ensure accountability for royalty obligations, compliance with the lease, permit safety, and environmental requirements. Field inspections are made at wells during the pre-drill, construction, drilling, and production phases. Inspections are also made during the plugging of the well, during reclamation, and periodically thereafter as necessary to ensure the reclamation is effective. Petroleum engineering technicians and surface reclamation specialists have primary responsibility for field inspections; however, other specialists may inspect wells as needed. Typically, these specialists include petroleum engineers, geologists, archaeologists, wildlife biologists, range conservationists, and others.

The primary function of the BLM petroleum engineering technicians is to account for accurate and complete measurement of production. They perform inspections to check the installation and calibration of measuring devices such as tanks for oil and flow meters for gas. BLM petroleum engineering technicians also inspect for routine environmental, public health, and safety concerns.

Operators are required to submit monthly production reports which go to the Minerals Management Service (MMS) and are available to the BLM inspectors electronically. The BLM verifies the report in the field to ensure the production volume is accurately reported. On the Reservation, the SUIT has a cooperative agreement with the MMS to verify that royalty payment is accurate. The three agencies work together to insure that all production is accounted for and that royalty is properly paid.

Operations within the jurisdiction of other federal agencies may also be field inspected by those agencies. The BLM has several agreements with other agencies that specify conditions where the BLM will notify the agency of violations within that agency's jurisdiction. In turn, the agency will notify the BLM of violations within its jurisdiction.

APPENDIX C
POTENTIAL FOR OIL AND GAS OCCURRENCE AND DEVELOPMENT

APPENDIX C
POTENTIAL FOR OIL AND GAS OCCURRENCE AND DEVELOPMENT

INTRODUCTION

The estimate potential impacts on the environment, the BLM provides guidance (BLM H-1624-1) for estimating the potential for oil and gas resources and for projecting the extent of development that is reasonably foreseeable over a certain period of time. In this case, it is the development of coalbed methane (CBM) that is most likely to occur on the Southern Ute Indian Reservation (Reservation) over the next 20 years.

The following sections contain explanations of: 1) the potential for oil and gas resources within the Reservation boundaries, and 2) reasonable foreseeable development and the three different alternatives that are addressed in this EIS.

POTENTIAL FOR OIL AND GAS RESOURCES

An estimate of oil and gas resources is accomplished using many sources of information including established files and databases, professional and academic literature, available oil and gas maps, well location cards, well completion reports, production reports, and previous mineral assessments.

The Reservation lies almost entirely within the San Juan Basin petroleum province. The entire Reservation can be described as prospectively valuable for oil and gas. "Prospectively valuable" is a federal classification for lands meeting certain criteria depending on the minerals involved. For oil and gas, and in the case of the Reservation, the lands are underlain by sedimentary rocks that lie within a favorable geologic and structural setting, are of sufficient thickness to contain economic volumes of hydrocarbons, and show evidence of oil and gas potential (e.g., seeps, well tests, production).

Most of the Reservation is considered to have high potential for oil and gas resources. Areas of high potential are characterized by the demonstrated existence of hydrocarbon source rock, appropriate thermal maturation regimes, reservoir strata possessing permeability and/or porosity, and traps to facilitate accumulation of hydrocarbons. In addition, the U.S. Geological Survey (USGS) has defined several plays in the San Juan Basin, six of which occur on the Reservation. A play is a target or zone that the USGS considers to have high potential for oil and gas resources. These plays fall within the area of high potential. A detailed discussion of each play can be found in Huffman (1988). Map 11 in the Map Volume of this EIS shows well development that has occurred within the Reservation to date. Map 11 shows that most of the exploration and development has occurred in the areas of high potential. The bulk of future activity is expected to occur in or near areas of high potential that have been explored or developed previously.

REASONABLE FORESEEABLE DEVELOPMENT SCENARIO

Projections of future oil and gas development and production are difficult to make. Several variables complicate such projections, including increases or decreases in demand for oil and gas; price increases or decreases; and new exploration, development, or production techniques that may prompt larger development and production programs. For this EIS, a combination of historical trends, present activity, government and industry estimates, and professional judgements were used in establishing the estimate of reasonable foreseeable development.

For the estimate of reasonable foreseeable development, it was assumed that all development would occur evenly over the ensuing 20-year period. Because of the many different entities operating on the Reservation and the great differences in production characteristics of wells, many different strategies may be pursued in future development of CBM leases. Some operators may elect to accelerate development if they have tax-credit qualified well bores available for recompletion as infill wells. Other operators may have equally compelling reasons to infill slowly (e.g., capital constraints). External forces such as rig availability or gas price changes also could affect development timing. In short, the exact pattern of future development is impossible to predict, so a flat development profile was selected as the most reasonable model for reasonable foreseeable development.

Throughout the environmental impact statement, a distinction is made between: 1) Tribal acreage, where the title both to conventional oil and gas and to CBM clearly rests with the federal government for the benefit of the Southern Ute Indian Tribe (SUIT) or its individual members, and 2) non-Tribal acreage, where title to the oil and gas resources and reserves, including CBM resources and reserves, belongs to Non-Tribal entities, primarily private citizens. Chapter 1.4 of this EIS contains a description and further explanation of this issue.

Reasonable foreseeable development on Tribal land is addressed in this EIS in three strategies, or alternatives: 1) continuation of the current or standard development, which would include both conventional and CBM development, including a component of CBM infill, 2) increased CBM production via widespread development of infill wells in addition to the current development, and 3) development of enhanced coalbed methane (ECBM) projects in addition to the widespread development of infill wells and current development. Anticipated numbers of wells for the three alternatives are summarized in Table C-1 and explained below. Development on non-Tribal lands within the Study Area was estimated for each alternative and used in assessing cumulative impacts.

Current or Standard Development

Current or standard development includes conventional oil and gas production from formations including the Dakota, Mesa Verde, and Pictured Cliffs and production of CBM from the Fruitland Formation. Although most of the Ignacio Blanco Fruitland field is spaced at one well per 320 acres,

orders allowing optional infill wells to be drilled have been approved for over 175 units. Development activity peaked in 1990 when over 200 wells were permitted within the exterior boundaries of the Reservation, spurred by tax incentives offered for development of unconventional reservoirs, such as CBM. The window for drilling tax credit qualified wells ended in 1992. More recently, activity on the Reservation has ranged between 15 and 20 newly developed wells per year on Tribal lands. Based on this trend, the RFD for standard development on the Tribal lands is projected to be approximately 350 wells over the next 20 years. For the RFD, only 81 of these were projected to be CBM wells; the balance would be conventional wells. On the non-Tribal acreage, 62 CBM wells are anticipated. On both Tribal and non-Tribal acreage, many of the CBM wells that are developed could be infill wells.

TABLE C-1
Projected Number of Wells by Alternative

	Alternative 1 Continuation of Present Management (No Action)			Alternative 2 CBM Infill Development			Alternative 3 ECBM Recovery (Proposed Action)			
	Conv	**CBM**	**Total**	**Conv**	**CBM**	**Total**	**Conv**	**CBM**	**Inj**	**Total**
Tribal Minerals	269	81	350	269	367	636	269	367	70	706
*Non-Tribal Minerals**	NA	70	70	NA	519	519	NA	519	67	586

Conv = Conventional
CBM = Coalbed Methane
Inj = Injection
NA = Not Applicable

* Note: The state has jurisdiction over oil and gas exploration and development on these lands. The described development may take place regardless of the status of this EIS.

Increased Coalbed Methane Development (Infill)

This component addresses the possibility of widespread infill development, essentially increasing CBM well density from one well per 320-acre spacing unit to two wells per 320-acre spacing unit over most of the Study Area. Widespread development of infill wells would be in addition to the current or standard development. Infill development would include recompletions of existing wells, drilling from existing pads, and drilling from newly constructed sites. Only approximately 50 percent of the infill wells are anticipated to be developed on newly constructed sites.

Known resource conditions, such as production rates and water disposal issues, suggest that infill development is unlikely to be strategic for every 320-acre CBM spacing unit within the Reservation. For the purpose of this analysis, it is projected that up to 367 CBM wells, including 286 infill wells,

will be developed on Tribal lands. On the non-Tribal acreage, assuming the same level of development as for the Tribal lands, 326 CBM wells, including 264 infill wells, are assumed to be developed. Total infill development on both Tribal and non-Tribal lands is thus projected at 693 wells.

Enhanced Coalbed Methane Development Projects

Industry was asked to provide for this EIS projections of potential ECBM projects assuming positive factors such as successful results from pilot projects and a strong economic climate. Currently, nitrogen injection has been pilot tested and is being implemented on a small scale in BP/Amoco's Tiffany project. Other operators indicated that they are analyzing or plan to analyze the effectiveness and economics of nitrogen injection on their acreage. Carbon dioxide injection is also being considered, although no specific project using carbon dioxide has been proposed at this time.

Nitrogen injection has been pilot tested on a five-spot pattern (four injections wells surrounding a producing well). Following successful pilot testing, the Tiffany project was designed as a field demonstration project. In this isolated, small scale project, there are 13 injectors and 35 producing wells, a ratio that is probably not characteristic of future, larger injection projects. Based on professional judgment, an injection pattern was defined for the purpose of this analysis as one injector well and two production wells (three wells total).

ECBM development would occur concurrently with the standard and widespread infill development. Consequently, it is assumed for this analysis that all necessary production wells are in place and that only injection wells need to be developed. To date, approximately 50 percent of the well bores used or designed for ECBM projects have utilized recompletion of existing well bores rather than drilling new injection wells. Thus, for the RFD, it is projected that approximately 50 percent of the injector wells needed would involve recompletion of existing well bores or drilling new well bores from existing pads. Pilot test projects would not be considered separately because they take advantage of existing wells to the maximum extent possible, and their impacts are substantially the same. As with infill development, ECBM projects are not likely to be implemented on all the available acreage for a variety of strategic reasons. Using the above assumptions, 137 injection patterns would be expected within the exterior boundaries of the Reservation, requiring development of 137 injection wells under the RFD. ECBM development is likely to be more applicable on the Tribal acreage than on the non-Tribal acreage due to reservoir conditions. This is reflected in the distribution of injection wells to Tribal and non-Tribal acreage as shown in Table C-1.

APPENDIX D
METHODOLOGY FOR ESTIMATING SURFACE DISTURBANCE IMPACTS

APPENDIX D
METHODOLOGY FOR ESTIMATING SURFACE DISTURBANCE IMPACTS

The inherent difficulty of a programmatic environmental impact statement (EIS) is to describe potential project impacts while the exact locations of future project sites are not known. To be able to consistently evaluate impacts on surface resources, as opposed to subsurface resources such as geology or hydrology, an impact assessment methodology was developed that utilized the geographic information system (GIS). Separate methodologies were developed for the conventional gas wells and for the coalbed methane (CBM) wells.

CBM AND ECBM WELLS

GIS provides a powerful computer tool to map, display, and analyze impacts. To take advantage of the power of these systems, a concept of "development windows" was developed for the CBM wells in the study area. Each development window corresponds to an area in which a CBM well could be drilled. Surface impacts were estimated by evaluating how much of which resources would be overlapped by development windows that would be developed under each of the Alternatives.

A typical 320 acre CBM spacing unit comprises half of a section, e.g., the north half of Section 11 Township 33 North, Range 11 West. Because of COGCC spacing rules, each unit is typically developed first by one well located near the center of a quarter section, not in the center of the half section. This development pattern leaves the other half of the spacing unit (a quarter section, or 160 acres) as a natural development window for a second, or "infill" well. In addition, existing conventional well pad locations were assessed for each of the development windows to identify opportunities to reduce surface impacts through use of existing well pads. Injection wells are not considered in the production well spacing and therefore do not have to be located in undeveloped "development windows".

<u>Development Windows</u>

A GIS analysis of the locations of existing CBM wells and of undeveloped spacing units and quarter sections provide the base for determining the development windows which could be developed under each alternative. Two types of development windows were used for estimating potential impacts from development of CBM production wells, 320 acre development windows and 160 acre development windows. The 320 acre development windows correspond to the undeveloped 320 acre CBM spacing units within the Study Area (Map 3). The 160- acre windows correspond to the quarter sections in the CBM development area which do not already contain a CBM well (Map 4). The 160 acre development windows are thus the quarter sections in which infill wells could be drilled. The presence of an existing conventional gas well within a spacing unit was not relevant to the

identification of CBM development windows and therefore did not affect whether or not the spacing unit became a development window. Each development window was designated as Tribal or non-Tribal, depending on the category of mineral ownership that holds the majority interest in the development window.

Determination of Number of Wells

The number of CBM wells for Alternative 1 (81 CBM wells on Tribal land) corresponds to the number of undeveloped CBM 320-acre spacing units on Tribal land in the Study Area. However, it is understood that some of the CBM wells developed under this Alternative would be infill wells. The number of conventional wells developed under Alternative 1 (269) corresponds to the difference between the total number of wells predicted based on recent development (350) and the 81 CBM wells predicted. This number of conventional wells was held constant in all three Alternatives.

For Alternatives 2 and 3, the Bureau of Land Management, Bureau of Indian Affairs and the Southern Ute Indian Tribe (SUIT) determined that approximately 80 percent of the available CBM development windows would actually receive wells. Therefore, a total of 367 CBM production wells would be constructed on Tribal lands under Alternative 2 or Alternative 3.

Because of the patchwork of Tribal and non-Tribal lands in the Study Area, the number of enhanced coalbed methane (ECBM) wells for Alternative 3 was determined by first evaluating the total number of ECBM wells which might be developed to support ECBM projects in the Study Area and then estimating the number on Tribal land alone. From this evaluation, it was determined that 70 injectors would be developed on Tribal land under Alternative 3.

Analysis of Impacts

Analysis of impacts for surface resources was obtained by counting all development windows that contain the resource (the overlap of the resource with development windows being developed under each alternative) and multiplying that total by the appropriate disturbance factor (Construction or Production Disturbance Factor). In other words, if a development window contained a particular resource, then that development window was assigned a CBM well. The number of development windows that would receive a CBM well was then totaled and multiplied by the appropriate disturbance factor.

Potential impacts from CBM development under Alternative 1 used the 320-acre CBM development windows because a large fraction of the 81 CBM wells that would be developed under that alternative were assumed to be parent wells, not infill wells. Potential impacts from CBM development under Alternatives 2 and 3 were evaluated using 160-acre CBM development windows because the majority of the CBM wells that would be developed under either of those alternatives

would be infill wells. The ECBM wells of Alternative 3 are not subject to spacing, although the environmental impacts of ECBM wells are analyzed.

There are two classifications of Construction Disturbance Factors for CBM and enhanced-recovery wells; these include wells requiring a new pad and wells drilled on existing pads. The Construction Disturbance Factor for a CBM well on a new pad requires a well pad (2 acres) and an access road and flowlines (0.25 mile x 35 feet wide = 1.06 acres) for a total of 3.06 acres. The access road and flowlines will generally occupy the same disturbed area. The construction disturbance factor for a well on an existing well pad includes only 1 additional acre of disturbance at the well pad. The construction disturbance factor is identical for CBM and ECBM wells.

The Production Disturbance Factor assumed that some interim reclamation of portions of disturbed sites would occur following construction. Therefore, the Production Disturbance Factor for new CBM and enhanced-recovery injection well pad sites was 2.06 acres (after reclamation of 1 acre around the wellhead) and 1 acre for installations on existing well pads. The Production Disturbance Factor is identical for CBM and enhanced-recovery injection wells.

Construction of a well on an existing conventional gas well pad reduces the area of surface disturbance. Through GIS, a querie was conducted to identify existing well pad sites within each resource. The analysis assumed that existing well pads would be used where available.

The number of CBM wells that could occur within each surface resource is a factor of the extent of that resource. Therefore, the more widespread a resource then the higher the number of CBM wells that could occur in that resource. It is possible that the number of wells delegated to a widespread resource (e.g., deer winter habitat) could exceed the total number of wells projected for an alternative. Where such a situation occurred, the number of wells delegated to that resource was limited to the number of wells for the alternative being analyzed.

If a given resource constituted less than 2 acres within a development window, then the resource was not evaluated for surface impacts within that particular development window. This decision was based on the assessment that any resource which was present within a development window in less than 2 acres could reasonably avoid project impacts through relocation of the installation.

Disturbances were not considered for central delivery points and treatment facilities because future expansion or modification of these facilities is anticipated to occur within the existing disturbance areas.

Conservative Nature of the Impact Analysis

Using GIS, it is possible to accurately assess the acres of various resources which could potentially be impacted by development of a specific development window. However, with a programmatic

EIS, it is not possible to accurately choose which development windows would receive a CBM well and which would not receive a CBM well. Many assumptions were made in doing the GIS analysis of the development windows. These assumptions were always made in the direction of being conservative in the estimation of impacts, i.e., to make the impacts appear, if anything, greater than they are likely to be. Actual impacts will likely be less than described. The following text provides descriptions of the "conservative" nature of this development window concept.

It is projected for the purpose of determining the number of wells that might be developed under Alternatives 2 and 3 that 80 percent of the development windows will be drilled for CBM. However, it is not possible to predict which development windows would be drilled and which would not. It was assumed all windows would have an equal probability to be developed. Consequently, impacts were assessed as if all (100 percent) of the development windows were actually drilled. Described impacts are therefore conservative since they are overstated by the difference between the projected CBM development of 80 percent and the analysis of total CBM development for 100 percent of development windows.

The development windows analysis is conservative in terms of estimating surface disturbances on resources. Every development window was evaluated if it overlapped a resource. If two resources were present in one development window, both resources would be counted as impacted by that development window. Consequently, a given development window could register impacts for a number of resources present within that development window (e.g., coniferous forest = 3.06 acres, grassland = 3.06 acres) even though the actual construction will impact only a total of 3.06 acres. This situation is referred to as "impact loading." Obviously, surface impacts are not intended to be additive between resource types with the model. For Alternative 1, the impact loading is even more extreme because the 320-acre development windows rather than the 160-acre development windows were used in evaluating impacts.

The 2-acre threshold for determining when a given resource occurs within a development window for impact analysis is also conservative. Under the regulations and the lease terms, a proposed drill pad (or other surface disturbance) can be moved up to 200 meters to avoid impacts on sensitive resources. The area of a circle with a 200-meter radius represents approximately 31 acres. Consequently, impacts on resources with small acreage representation within a development window (but larger acreage representation than 2 acres) could probably be avoided by relocating the disturbance.

CONVENTIONAL GAS WELLS

As discussed under CBM and ECBM Wells, the number of conventional gas wells (269 wells) was projected by combining recent drilling trends with projections about future development. The number of conventional gas wells (269 wells) remains a constant for all alternatives.

New conventional wells could be assumed to be drilled anywhere within the study area, as opposed to CBM wells which would be drilled east of The Hogback. In order to evaluate the surface disturbance impacts from the proposed conventional wells, the extent of impacts on a surface resource was considered to be proportional to the area of the resource within the study area. Specifically, the percentage of a resource within the study area was calculated by dividing the resource acreage by the total acreage of the study area. The resulting percentage was then multiplied by the total number of projected conventional wells (269) to determine the number of conventional wells which could impact that particular resource. To obtain the area of surface disturbance, the number of wells was multiplied by the appropriate disturbance factor (e.g., construction or production; new well pad or existing well pad). Through the GIS system, a querie was conducted to determine the number of existing well pads within each resource. The impact analysis assumed that existing well pads would be utilized where available. The presence of a conventional well within a spacing unit (e.g., a Mesa Verde completion) does not preclude the presence of a future conventional well completed from a different formation (e.g., a Dakota completion).

The Construction Disturbance Factor for a new well includes 2 acres for the well pad and 1.06 acres for the access road and flowline (0.25 mile x 35 feet wide = 1.06 acres) for a total of 3.06 acres. The roads and flowlines will generally occupy the same disturbed area. The Construction Disturbance Factor for development of a conventional well on an existing well pad includes only 1 additional acre of disturbance to the existing well pad.

The Production Disturbance Factor assumed that some interim reclamation of disturbed sites would occur following construction. Therefore, the Production Disturbance Factor for new well pad sites was 2.06 acres (after reclamation of 1 acre around the well head) and 1 acre for sites developed on existing well pads.

New conventional wells could be assumed to be drilled anywhere within the study area, as opposed to CBM wells which would be drilled east of the Hogback. In order to evaluate the surface disturbance expected from the proposed conventional wells, the extent of impacts on a surface resource was considered to be proportional to the area of the resource within the study area. Specifically, the percentage of a resource within the study area was calculated by dividing the resource acreage by the total acreage of the study area. The resulting percentage was then multiplied by the total number of projected conventional wells (269) to determine the number of conventional wells which could impact the particular resource. To obtain the area of surface disturbance, the number of wells was multiplied by the appropriate disturbance factor (e.g., construction or production; new well pad or existing well pad). Through the GIS system, a query was conducted to determine the number of existing well pads within each resource. The impact analysis assumed that existing well pads would be utilized where available. The presence of a conventional well within a spacing unit (e.g., Mesa Verde completion) does not preclude the presence of a future conventional well completed into a different formation (e.g., Dakota completion).

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APPENDIX E
EXISTING ENVIRONMENTAL PROTECTION MEASURES FOR OIL AND GAS OPERATIONS ON THE SOUTHERN UTE INDIAN RESERVATION

APPENDIX E

EXISTING ENVIRONMENTAL PROTECTION MEASURES FOR OIL AND GAS OPERATIONS ON THE SOUTHERN UTE INDIAN RESERVATION

The following regulations and orders (not included due to their size) are the basis for oil and gas development on the Southern Ute Indian Reservation:

- 43 CFR 3160; Onshore Oil and Gas Operations Regulations, which include the following Onshore Oil and Gas Orders:
  - Onshore Order #1; Approval of Operations,
  - Onshore Order #2; Drilling Operations,
  - Onshore Order #3; Site Security,
  - Onshore Order #4; Measurement of Oil,
  - Onshore Order #5; Measurement of Gas,
  - Onshore Order #6; Hydrogen Sulfide Operations,
  - Onshore Order #7; Disposal of Produced Water.

The following documents contain existing environmental protection measures applicable to oil and gas development on the Southern Ute Indian Reservation, and are included in this Appendix:

- Notices to Lessees:
  - NTL-88-1; Well Abandonment and Bonding Requirement Revisions.
  - NTL-88-2-Colorado; Paying Well Determinations and Venting and Flaring Applications on Jurisdictional Coal Bed Methane Wells.
  - NTL-MDO-91-1 (Change 1 and Change 2); Bradenhead Testing.
  - IB 95-1; Prevention of Potential Bird and Bat Mortalities.
- SUIT General Well Site Conditions of Approval;
- SUIT General Pipeline Right-of-Way Stipulations ; and
- Mitigation Measures from the Environmental Assessment of Oil and Gas Leasing and Development on Southern Ute Indian Reservation, BIA, 1990.

Colorado NTL-88-1

United States Department of the Interior
Colorado Bureau of Land Management

Notice to Lessee/Operators of Onshore
Federal Oil and Gas Leases Within the
Jurisdiction of the Colorado State Office

NTL-CO-88-1

Well Abandonment and Bonding Requirement Revisions

This notice is to inform lessee/operators of the Bureau of Land Management (BLM) policy that has been developed in response to the recommendations presented by the Bonding Task Force to the Washington Office.

The Task Force was set up as a result of widespread industry concern about a proposal to amend the existing fluid mineral bonding requirements that was published in the May 1, 1985, Federal Register. The rulemaking would have consolidated the existing bond types and increased the present bond amounts which had only been adjusted once in 56 years. This Task Force was mandated to review the bonding issue, solicit industry views, evaluate various alternatives, and provide the Director with recommendations. The Task Force has completed its review and submitted its final recommendations (Enclosure).

As a result of these recommendations, the BLM has instituted a phased release of bond liability. The phased release of bond liability applies only to federal wells. The Bureau of Indian Affairs is responsible for acquiring and releasing the bonds on Indian leases and it has no similar provisions for the phased bonding release. This policy applies only to single lease bonds and only to the abandonment of the last or only well on a lease. Normally, these are the $10,000 bonds for lessees, operators, or designated operators. Under the phased release, the authorized officer (AO) will be able to reduce the amount of the bond upon completion and inspection of different phases of abandonment. In Colorado, the program will consist of two phases. Phase I goes into effect after proper plugging of the leasehold's well(s) and after the site has been stabilized and seeded. Phase 2 goes into effect once reclamation is deemed complete, i.e., the site has been successfully revegetated and reclamation can be approved. Depending on the location of the site and the amount of reclamation that was required, a percentage of the bond liability can be released at Phase 1. This percentage will vary, but may go as high as 80 percent. Upon successful revegetation (Phase 2), the bond would be totally released, provided all other work necessary on the lease has been completed. The principal and surety will both be notified of our actions at each phase.

As part of the Colorado State Office review of the procedures for this process, the procedures that lessee/operators were following with regard to the permanent abandonment of each newly completed well, recompleted well, or producing well not capable of producing oil or gas in paying quantities were also examined. As a result of this examination, the procedures for permanent abandonment have been revised to incorporate phased bonding release. The entire process is as follows:

1. Notice of Intention to Abandon (NIA) (Form 3160-5, Sundry Notice) notification of proposed

plugging procedures, or confirmation of verbal plugging procedures. If plugging operations are not commenced within 30 days of approval, the operator must submit a request for approval to temporarily abandon the well, including the date when plugging operations are expected to take place.

2. Subsequent Report of Plugging (SRP) (Form 3160-5, Sundry Notice) notification within 30 days following execution of plugging, detailing procedures used for the plugging operation, including method, waiting on cement times, any tags, and any problems or abnormalities. Surface reclamation should be addressed under a separate Sundry Notice or letter.

3. Subsequent Report of Abandonment (SRA) (Form 3160-5, Sundry Notice) notification of completion of surface restoration (dirt work and reseeding). The SRA should not only detail the work that was done but also request partial bond liability release. This Sundry Notice is only required when requesting partial liability release of a single lease bond; it is optional in all other cases. Operators who do not request phased bond release should include the dirt work and reseeding information in their Final Abandonment Notice (FAN) (see item 4). The SRA is an acceptance rather than an approval action. The lease will be inspected at this time to assure that the dirt work and reseeding meet APD requirements. If there are any questions as to how the dirt work should be completed, the operator should request an inspection prior to removal of earthmoving equipment.

4. Final Abandonment Notice (FAN) (Form 3160-5, Sundry Notice) notification to the AO that restoration of the disturbed surface area has been completed, including adequate vegetational growth, and the location is ready for inspection. Operators who do not request partial bond release should submit all surface restoration and reclamation information for this location on this notice. On Form 3160-5, check "Other" box under "Subsequent Report of" and fill in "FAN" in the blank provided. BLM approval of final abandonment must wait the length of time necessary to rehabilitate a location and access road and obtain a sufficient stand of vegetation for inspection. Depending on what part of the state your operations are in, this waiting can take from 1 to 4 years. Upon successful rehabilitation of the last well on a single bond lease, the bond may be released, provided all other work necessary on the lease has been completed.

Once the NIA has been submitted, a copy will be made and forwarded to other Surface Management Agencies (SMA), if applicable, for any revised reclamation stipulations, confirmation of water well conversion, etc. The SMA or Resource Area is responsible for approving or establishing the methods and special requirements for surface rehabilitation and determining when this rehabilitation has been satisfactorily accomplished. As such, once the FAN has been submitted, a copy will be made and forwarded to other involved SSMAs if applicable. The BLM has made a commitment that an inspection to determine if reclamation is satisfactory will be made within 60 days of receipt of a FAN, weather permitting, provided BLM is the SMA and assuming the FAN is filed when reclamation is complete. If the BLM or other SMA inspection reveals satisfactory reclamation, the FAN is approved. If the well is the last producing well on the lease and the lease is in good order, a bond release recommendation will be made to the Colorado State Office, provided all other work necessary on the lease has been completed.

If there is more than one single lease bond for that particular leasehold, all bonds will be released by the same amount. The remaining amount of the partially released bond is an "acceptable alternative" to the full bond amount as the bond would be progressively reduced to an amount commensurate with the leasehold's risk. For wells where the bonding is different for deep and shallow formations, phased releases will occur by segregation, i.e., when the last shallow well is plugged, phased bond release for the shallow bonds could occur. Bonds for the deep wells would continue to be held. The site will be inspected at each phase before partial or complete liability release can occur. The BLM has made a commitment that, allowing for weather, etc., a field inspection will be made following a lessee or operator request, for either phase, so that bond reduction or release can be completed within 60 days of the request.

Please be aware that the above procedures must be followed for all abandonments whether or not the operator requests partial bond liability release.

Operators who have already filed SRAs in the past and who wish to clear the books of those wells that have been rehabilitated may file a second SRA and/or FAN at the appropriate jurisdictional office.

Date: December 30, 1987 Approved by: Ralph Smith,
Acting State Director

Enclosure

BONDING TASK FORCE
FINAL RECOMMENDATIONS

INTRODUCTION

On May 1, 1985, the Bureau published in the Federal Register a proposal to amend the existing fluid mineral bonding requirements. The rulemaking would have consolidated the existing bond types from twelve to only four, combining b oil and gas with geothermal and seismic with drilling bonds, and would also have increased the present bond amount: been adjusted only once in 56 years.

This proposed rulemaking received a mixed response from industry. While most commentors were supportive of bor consolidation, they were strongly opposed to increasing the bond amounts. Their opposition stemmed from concerns the ability to obtain new bonds at the higher amounts, the current economic state of the oil and gas industry, and the ' health" of surety companies.

Because of these widespread concerns underlying the Bureau's bonding requirements, the Director convened a task of three State Directors (New Mexico, Chairman, California and Wyoming) and a representative from the Minerals Ma Service. The U.S. Forest Service and the Office of Surface Mining have attended ex officio. This task force was mar review the bonding issue, solicit industry views, evaluate various alternatives and provide the Director with recommen

The task force has completed this evaluation and developed their final recommendations. These recommendations a below along with other alternatives which were considered but did not merit recommendation.

FINAL RECOMMENDATION

1. Maintain present bonding requirements including present types of bonds and bond amounts but add provisions in regulations to allow for:

a) "Piggyback" on State oil/gas bonds where possible. Under this arrangement, operators who have State oil and gas bonds would, with the State's permission, satisfy the Bureau's bonding requirements through these State bonds. This is already the practice in the Bureau's locatable minerals program and it would relieve operators of the cost of 'double' bonding. Steps would be taken to coordinate actions between BLM and willing State governments.

I Concur: signed Robert Burford

b) Allow third party surety bond coverage of lessee or operator. This provision would allow a party other than the operator or lessee to provide the bond to the Bureau to cover the operator's activities. The advantage lies in the operator/lessee not needing to qualify for surety bonding but only having to find a patron to provide the bond , perhaps at a cost lower than for a surety bond for the operator/lessee.

I Concur: signed Robert Burford

c) Accept letters of credit in lieu of bonds. This regulatory change would allow the use of irrevocable letters of credit in place of surety bonds. They would be issued by a financial institution such as a bank and the Bureau would be named as the sole payee. Letters of credit would provide a sound source of funds and may be easier for some to obtain than surety bonds.

I Concur: signed Robert Burford

2. Remind field offices by instruction of the opportunity to raise bond amounts where appropriate. The Bureau currently has the authority to raise the amount of any bond when additional coverage is determined to be appropriate. The purpose of this instruction would be to emphasize this current authority and to encourage its use when necessary The field offices, however, would be cautioned to increase bonds on a selective basis and to adequately document su decisions.

I Concur: signed Robert Burford

3. Instruct field offices to release individual well bond liability as soon as possible after receiving request. Delays in releasing bond liabilities have made it difficult for some operators to acquire other bonds since surety companies look at existing bonds as outstanding financial obligations. This change would allow a staged release of bond liability, whereby the bond would be promptly reduced to a much lower amount upon completion of all abandonment/reclamation work except revegetation. A small portion of the original bond amount would be retained until the final stage (revegetation) is completed.

I Concur: signed Robert Burford

4 Seek legislation to make a portion of the Reclamation fund proceeds available for oil/gas, geothermal, or mining reclamation. This fund receives a significant percentage (42 percent) of its total proceeds from oil and gas receipts. However, such proceeds are not available for reclamation work because, by statute, the purpose of the fun(for the "construction and maintenance of irrigation works." This proposal would seek legislation whereby the monies credited to the fund from oil and gas leasing would be "net" the amounts needed to cover reclamation or related losse

I Concur: no signature

NO RECOMMENDATIONS ON:

1. Changes in bond amounts. Changes in the existing bond amounts are not recommended at this time due to: the current depressed oil and gas market, the uncertain impact on the ability of operators to secure new bonds, and tl availability of preferable alternatives.

2. Bond consolidation (i.e., with seismic or geothermal). It is not recommended that oil/gas bonds be consolidated with seismic bonds because few firms engage in both activities and where there are both undertakings, with the same firm they are usually separate. Neither is it recommended that bonds for oil/gas and geothermal activities be consolidated due to the substantial differences between the two.

3. Action on other types of bonds (OTHER THAN oil and gas and geothermal as well as mining, as above). No other recommendations are presented for any other types of bonds because no such need was uncovered during this evaluation because of the narrow focus of the task force's work.

4. Bond funds (i.e., "super fund" concept). The establishment of a bond fund for oil and gas reclamation would require specific legislation and impose significant administrative workloads. A bond fund could also generate controversy regarding the collection of fees and disbursement of payments. There was initial extreme opposition to any such mutual schemes by industry spokespersons.

5. Abolishment of bonds. The elimination of bonding requirements, it was felt, would impose an unacceptable risk upon the Federal Government and taxpayer. This elimination would also require legislation and would likely mee with public opposition.

6. Expanded types of bond collateral. Allowing operators to post collateral in lieu of a surety bond would be administratively burdensome as the Bureau would be required to appraise, manage, and protect any assets. Problem could also arise in converting the assets to cash to exercise attachment of the "bond".

7. Self bonding. Under this option, an operator could submit evidence of the company's financial strength and demonstrate financial responsibility in lieu of submitting a bond. This approach would impose a significant administrative workload on Government to assess credit worthiness and require specialized financial expertise. Furthermore, at least one State which currently uses this approach is considering disallowing its use because of these very problems.

8. Priority collection on a bond. Also considered, but without recommendation, is the issue of whether the Bureau or Minerals Management Service (MMS) should have priority in collecting on an oil and gas bond if there is both a royalty loss (MMS) and a loss from improper or no reclamation (Bureau). The issue was raised because the Bureau would have to cover the actual reclamation outlay from its appropriation if there was not a sufficient share of the bond for BLM. MMS losses are unrealized gains. The task force decided that such matters may be best handled on a case by case basis. However, the MMS/BLM Steering Committee may wish to consider this item to determine whether it warrants a policy recommendation. This issue is also being considered by a special task force and recommendations are due by April 17, 1987.

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Colorado NTL-88-2

Department of the Interior
Colorado Bureau of Land Management

Notice to Lessee/Operators
of Onshore Federal Oil and Gas Leases
Within the Jurisdiction of the Colorado State Office

NTL-CO-88-2

Paying Well Determinations and Venting, and Flaring
Applications on Jurisdictional Coal Bed Methane Wells

This notice is to inform lessee/operators of the Bureau of Land Management Colorado State Office's policy in regard to the processing of paying well determinations and venting and flaring applications on federal coal bed methane wells within the state of Colorado.

Production characteristics of coal bed methane gas wells are radically different than gas wells completed in conventional reservoirs. The traditional methods and procedures for doing paying well determinations cannot be applied to coal bed methane production. For those leases in or approaching extended terms on which the only production is coal bed methane, a premature nonpaying well determination may lead to loss of resources and royalties and this is clearly not in the best interest of either the lessor or the lessee.

The guidance outlined below is intended to deal with the problems associated with doing paying well determinations on coal bed methane wells.

Coal Bed Well Classification

A coal bed methane well is defined as any well predominantly completed in coal seams (usually based on electric logs, drilling time, drill cuttings, mud logs, completion reports) making measurable amounts of methane gas and generally characterized by the following parameters:

1. Reservoir performance data such as inclining gas production over time.
2. Associated high water production generally requiring artificial lift.
3. Water analysis showing relatively high bicarbonate content.
4. Gas analysis showing relative low BTU value with associated carbon dioxide.
5. Potential formation damage as a result of shutting in the well.
6. Possible detrimental effects from water encroachment as a result of shutting in the well.

Some wells may not exhibit all six of the above characteristics, but may still be classified as coal bed methane wells if conclusive evidence is provided by the operator. These classification standards do not apply to a Federal Energy Regulatory Commission category 107 determination.

Paying Well Determinations on a Leasehold Basis

Leasehold paying well determinations for wells classified as coal bed methane wells will be a two-stage process as described below:

1. Prepare an initial paying well determination.

Sufficient cost and income data are usually not available at the completion of coal bed methane to perform a typical paying well determination. An initial paying well determination can be granted for classified coal bed methane wells if it appears that a prudent operator would continue to operate the coal bed methane well in expectation of improving the well's performance. If the lease is approaching the end of its primary term and is not otherwise held by production, a positive initial paying well determination will serve to extend the lease as held by production. The operator will then be granted a period of time up to one year from the completion date of the well to continuously test the well. This initial testing period will be used to establish a baseline for monitoring the anticipated gas incline/water decline response.

The accurate measurement of water during this one-year testing period will be as important as the accurate measurement of gas for the purpose of evaluating the well's response. If requested, additional six-month extensions of the one-year testing period may be allowed. The total testing and demonstration period shall not exceed two years unless extensions of the testing periods have been granted due to an unavoidable delay situation deemed to be beyond the control of the operator, which prevents continuous operations. Any extended testing/producing period must be justified by .facts that indicate a prudent operator would continue to produce the well in anticipation of improving its performance. Any lease extended by a positive initial paying well determination will be closely monitored to ensure the continuous production of the well.

Any lease that is considered to be held by production due to a positive initial paying well determination on a coal bed methane well will be considered to be on minimum royalty, not advanced rental. A positive Initial paying production determination may result in the issuance of a first production notice.

2. Prepare a final paying well determination on a leasehold basis.

A favorable fiscal paying well determination could be made at any time the initial testing period leads the authorized officer to believe that the gas production would increase to some point within the next six months so the well would be capable of producing leasehold substances in paying quantities. A final nonpaying well determination could be made at any time the information warrants such a decision. If a nonpaying well determination is conducted for the last well that was considered to be extending on the lease, then the lessor/operator would have to be given 60 days to restore some type of paying production to prevent lease termination.

A lease considered to be held by production due to a positive initial paying well determination may also be subject to termination prior to a final paying well determination if one of the following two circumstances occur: (1) the approved period of continued production expires or (2) diligent producing operations cease without acceptable justification. Should one of these circumstances occur, such a lease would be terminated effective the date of notification of the circumstance unless the lease has another satisfactory source of paying production or diligent operations to restore paying production are commenced within 60 days after notification.

For coal bed methane wells, a final paying well determination is the same methodology used for conventional oil and gas wells in that we must determine if the well can produce sufficient quantities to overcome operating/overhead expenses which should not include capital well/facility investments. The only variance would be the high cost of disposing of produced wastes, and coal bed methane wells are anticipated to initially produce abnormally high volumes of water. This would be a severely limiting factor in the economics of a determination. To mitigate this effect, the costs of water disposal would be prorated over a period of ten years or the projected life of the well, whichever is less.

The relevant circumstances the authorized officer may use in reaching a paying well determination can include the engineer's best professional judgment as to whether and to what extent the well in question will perform, compared to the prevailing theory for coal bed methane production at the time of the determination.

Paying Well Determination on a Unit Basis

The process discussed for initial paying well determinations on a leasehold basis can be applied to coal bed

methane wells drilled under the terms of a unit agreement. If such a determination is made. it would serve to hold any expiring leases in accordance with the 67 IBLA 246 Yates Petroleum Company decision dated September 24, 1982.

A coal bed methane unit well which has had initial paying well determinations will not satisfy the drilling requirements established under section 9 of the model form of the unit agreement. Drilling must continue until a discovery of unitized substances in paying quantities is made. A well which has had an initial paying well determination is not considered to be a well capable of producing unitized substances in paying quantities. To accommodate extended testing/producing requirements for establishing unit paying production, section 9 may he amended to allow for extended drilling, timeframes between the completion of one coal bed methane well and the commencement of another.

Final paying well determinations for coal bed methane unit wells are different than the final determinations as described in item 2 above for leasehold wells. Again, it is the intent of such a final determination to demonstrate that the unit well is capable of producing methane gas, a unitized substance, in paying quantities. To accomplish this, inclined methane and prorated water production rates will be used to determine if a well has the capability to produce unitized substances in sufficient quantities to repay the cost of drilling, completing, and producing operations with a reasonable profit. As long as the cash flow remains positive, there is no limit to the number of years for payout.

Venting and Flaring

Limited evidence in the field suggests that there may be a significant risk associated with shutting in a coal bed methane well even for a short time (i.e., a few days). At best, the benefits of dewatering the coal seam will be hindered, and at worst, the well could be lost. Consequently, venting and flaring issues will need to be addressed. This Is especially true during periods of market curtailment. Venting and flaring approvals will be processed as follows:

1. Development wells

A development well is defined as any well within one-quarter of a mile of a feasible pipeline hookup. Venting and flaring will be administratively authorized on development wells until an initial paying well determination is made. In most cases, the initial paying well determination will be made within a 30-day period following completion or recompletion of the well. For the most part, development wells will follow the existing procedures in NTL-4A. That is, after the initial 30-day period following completion or after the initial paying well determination is made, whichever occurs later, gas will be considered avoidably lost and royalty will accrue unless an NTL-4A application is approved to continue venting and flaring as it is uneconomic to capture the gas.

2. Step-out/wildcat wells

Step-out/wildcat wells are defined as new wells greater than one-quarter mile from an acceptable pipeline hookup. A with development wells, the venting and flaring will be administratively authorized until the initial paying well determination is made. Any additional venting and flaring after the initial paying well determination is made will require the approval of an NTL-4A application. Generally, the venting and flaring will be authorized as unavoidably lost under the special well test provisions, and royalties would not accrue until a final paying well determination is made.

3. Venting and flaring after the final paying well determination

After the final paying well determination is made for step-out/wildcat wells, the gas vented and flared will generally be considered as avoidably lost and royalties will accrue. It should be noted that existing guidance allows for the unavoidable short-term venting or flaring of gas without incurring royalty obligation in certain circumstances. These circumstances include temporary emergency situations (i.e., equipment failures, relief of abnormal pressures, market disruptions), routine purging, or other conditions which result in the unavoidable short-term venting or flaring of gas. This authorization is limited to 24 hours per incident and to 144 hours total for the lease during any calendar month.

If you have any questions concerning this matter, please contact Rick Ryan of this office at (303) 239-3751, or Kent Hoffman or Jim Lovato of the San Juan Resource Area Office at (970) 247-4082.

Date: September 26, 1988 Signature: Tom Walker,
Associate State Director

BRIEFING PAPER

ISSUE: Should Colorado Notice to Lessee/Operators (NTL): NTL -CO-88-2, "Paying Well Determinations and Venting and Flaring Application on Jurisdictional Coal Bed Methane Wells" apply to Indian lands as well as federal lands?

1. Background

Coal degasification activities an federal and Indian land in the state of Colorado has significantly increased during FY 1988. A large majority of the activity is located on Indian land in the San Juan Resource Area. Typically these coal degasification wells produce significant volumes of water and small amounts of methane gas at completion. As the well is continuously produced, the water production decreases and the methane gas production increases. These inclined gas production rates can take a considerable amount of time to establish. The net effect is that a coal bed methane well's peak gas production is established much later in the life of the well, unlike a conventional gas well.

This office felt that inclined production curves and extended testing requirements to establish this production history would have direct impact on existing operational policies which have been developed for conventional gas wells. In conjunction with the San Juan Resource Area, this office took the initiative to examine the following issue areas that directly impact coal bed methane operations on federal and Indian land: 1) when can a gas well be considered a coal bed methane well, 2) what production rates must be sustained by that well to extend a lease, and, 3) how much gas could be flared or vented royalty free during the extended testing/producing periods.

It was the consensus of this office and the San Juan Resource Area that a lease should not terminate at the end of its primary term if it contains a coal bed methane well that will become more prolific as the well is continually produced. This office took the lead to develop a policy concerning these issue areas and felt that a NTL for both federal and Indian lands should be issued so all coal bed methane operators would be adequately informed of this policy.

Operators soon began to realize that the unique producing aspects of coal bed methane wells would have a direct impact on their lease terms. To deal with the above issue areas, along with spacing requirements and NGPA classifications, they formed a committee entitled the Fruitland Coalbed Methane Committee. Both the Bureau of Land Management and the Southern Ute Indian Tribe were members of this committee. The San Juan Resource Area Office presented our NTL to the committee in draft form for comment. The committee, which included the representative from the Southern Ute Indian Tribe, had no objections to the issuance of the NTL as it applied to both federal and Indian land.

II. NTL Policy Issues

A. Paying well determinations. Present guidelines in the Bureau state that a paying quantities determination is a determination as to whether or not, under all relevant circumstances, a prudent operator would continue to operate a well in the manner in which such well is being operated for the purpose of making a profit and not merely to hold the lease for speculation. It is our contention that if an operator is continually testing/producing a coal bed methane in attempt to incline production rates to the point of economic feasibility, then the operator is diligently attempting to establish a viable gas resource on the lease. An initial paying well determination can be granted as long as testing/producing operations remain continuous and the authorized officer has determined that through these testing operations, the operator can reasonably expect production to incline significantly.

Extraordinary expenses should not be included in a paying well determination. Only those costs incurred on a day-to-day basis and which are expected to occur in the future should be considered. Pursuant to this existing burea policy the NTL suggests that inclined production rates and prorated water disposal costs should be used in an economic valuation. These factors are typically experienced by a coal bed methane well in the foreseeable future as t well is produced.

2. Venting/Flaring. NTL-4A states that gas vented/flared during a special test period can be considered unavoidably lost. Therefore, until a coal bed methane well is tested significantly to establish economic inclined producing rates (i.e., final paying well determination), the testing period can be considered special and therefore all

gas vented/flared can be considered unavoidably lost. However, those wells reasonably close to a pipeline hook-up and not considered to be subject to this special test provision since there is a nearby marketing outlet for the gas duri the extended testing period.

3. Limits on the amount of time an operator can spend diligently testing/producing a coal bed methane well pri to a final paying determination being conducted by the authorized officer were established (i.e., not to exceed two years). The rationale for this being that after certain point if the operator has not obtained satisfactory inclined production rates, then the operator is simply operating the well for possible lease speculation and not for the purpose of making a profit.

III. Implementation

After receiving concurrence from the Fruitland Coalbed Methane Committee, this office distributed the NTL to the Rocky Mountain Oil and Gas Association, Independent Petroleum Association. of Mountain States, Colorado Oil and Gas Conservation Commission, Southern Ute Indian Tribe, Fruitland Coal Bed Methane Committee, and the district offices. The only objection to the issuance of this NTL was received from the Souther Ute Indian Tribe. It should be noted that as a Fruitland Coal bed Methane Committee member, the Southern Ute Indian did not appear to have any objections to the NTL at that time.

IV. Conclusion

This NTL is in conformance with all existing regulations and policies. The NTL establishes a uniform policy to be applied to all coal bed methane operations in the state of Colorado. Through the issuance of this NTL, operators will understand what performance standards have been established for their coal bed methane operations. Each operator should not have to negotiate a separate agreement with the mineral management agency to determine what they must accomplish with their operations to perpetuate a lease. The NTL will be issued for federal lands. The issuance of the NTL for Indian lands will be deferred until a decision is reached by the Washington Office.

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www.co.blm.gov/oilandgas/ntl-88-2.htm
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United States Department of the Interior

BUREAU OF LAND MANAGEMENT
San Juan Resource Area Office
701 Camino Del Rio
Durango, Colorado 81301

Notice to Lessees (NTL) and Operators of Federal and Indian Oil and Gas Leases within the Ignacio-Blanco Field

NTL MDO-91-1, Change 1

April 15, 1998

This change notice is issued pursuant to the authority delegated to the Authorized Officer (AO) under 43 CFR 3161.2 and 43 CFR 3164.2 to implement oil and gas operating regulations pursuant to 43 CFR 3160 and the terms, conditions, and attached stipulations of the Federal and Indian oil and gas leases. In accordance with the regulatory guidelines referenced above, lessees and operators shall conduct operations in a manner which protects the health, safety, and welfare of the public in addition to protecting natural resources and the environment. Operations shall also be conducted in a manner which results in maximum economic recovery of the oil and gas resources with a minimum amount of waste.

I. Background

On July 23, 1991, the Bureau of Land Management (BLM) issued NTLMDO-91-1 (Bradenhead Testing). That notice was-issued in response to evidence of methane contamination in groundwater as documented in water quality analyses of domestic water wells. Since 1991, the BLM has aggressively implemented the terms and conditions of NTL MDO-91-1. The Colorado Oil and Gas Conservation Commission (COGCC) has also implemented and enforced similar requirements for gas wells on state and fee lands.

As a result, the extent and magnitude of gas wells exhibiting mechanical integrity problems identifiable by this process has been ascertained. Concurrent with the bradenhead testing effort, water well testing has been conducted to identify the presence of entrained methane contamination. These combined efforts have helped the BLM delineate "Critical Areas" where methane contaminated water wells exist.

Bradenhead testing has helped the BLM and the COGCC identify gas wells requiring remediation. Well remediation efforts have reduced the potential for contamination of shallow groundwater aquifers and losses of hydrocarbon resources associated with natural gas production. The overall number of gas wells

exhibiting bradenhead pressure above the established threshold of 25 psig (2 psig in the Critical areas) have been significantly reduced.

Test data suggests that a less frequent level of monitoring can be implemented while providing an effective level of control to assess potential changes in wellbore integrity. On the basis of seven years of bradenhead testing, the BLM has determined that methane contamination and loss of the hydrocarbon resource is more likely to occur at older conventional gas wells than in newer Fruitland Formation coal gas wells. This fact is a function of improved primary cementing requirements including circulation of cement through well-bore annul) from the producing horizon to the surface, thereby maximizing the potential for zonal isolation between the gas producing horizon and shallow aquifers.

II. Definitions

As used in this notice, terms are defined as follows:

A. "Authorized officer" (AO) - shall mean the San Juan Resource Area Manager.

B. "Conventional Well" - A well completed in any sandstone reservoir namely the sands of the Dakota, Mesaverde, and Pictured Cliff Formations.

C. "Fruitland Formation Coal Gas Well" - A well completed in the coal seams of the Fruitland Formation.

D. "Critical Area" - Areas around domestic water wells which exhibit greater than 1 mg/L entrained methane (See attached

map).

III. Requirements

This NTL modifies NTL MDO-91-1, by revising both the frequency of required bradenhead testing and adding new gas analysis requirements based on pressure, volume, and well location. Requirements are applicable only to the Ignacio-Blanco Field in Southwest Colorado and are as follows:

1) Annual bradenhead testing requirements, in accordance with NTL MDO-91-1, for all conventional gas wells and all conventional gas wells recompleted as Fruitland

Formation coal gas wells.

2) Biennial bradenhead testing will now be required on Fruitland Formation Coal Gas Wells completed in the Fruitland Coal prior to 1998.

Biennial testing will be required on odd numbered years, beginning in 1999, (eg., gas wells meeting the above criteria for biennial testing will not need to be tested in 1998). Fruitland Formation Coal Gas wells drilled in 1998 and beyond will have no history of bradenhead testing. Therefore, these gas wells will be required to have an initial test conducted upon completion followed with biennial testing thereafter.

3) All gas wells having approved Notices of Intent to remediate excessive bradenhead pressure by implementing bradenhead venting and/or wellbore/well head repairs are governed by their attached Conditions of Approval which overrule items #1 and #2 above.

4) Bradenhead gas analysis is required only when gas volume is sufficient to allow a minimum of 10 purges of the collection cylinder, and when pressures exceed 2 psig in designated critical areas or 25 psig outside of designated critical areas.

In 1998, intermediate casing gas samples will be required only when specifically requested by the BLM.

IV. Conformance with NTL MDO-91-1

NTL MDO-91-1, remains in full force and effect except where modified by this NTL.

Date Area Manager, San Juan Resource Area

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In Reply Refer To: BLM: 3162.5
Date: February 22, 2000

Notice to Lessees and Operators of
Oil and Gas leases within
the Ignacio-Blanco Field
Southwestern Colorado

Final

NTL-MDO-91-1, Change 2

February 22, 2000

This change notice is issued pursuant to the authority delegated to the Authorized Officer (AO) under 43 CFR 3161.2 and 43 CFR 3164.2 to implement oil and gas operating regulations pursuant to 43 CFR 3160 and the terms of the Federal and Indian oil and gas leases. In accordance with the regulatory guidelines referenced above, lessees and operators shall conduct operations in a manner which protects the health, safety, and welfare of the public in addition to protecting natural resources and the environment. Operations shall also be conducted in a manner which results in maximum economic recovery of the oil and gas resources with a minimum amount of loss.

I. BACKGROUND

On July 23, 1991, the Bureau of Land Management (BLM) issued NTL-MDO-91-1 (Bradenhead Testing). This notice was issued in response to evidence of methane contamination in groundwater as documented in water quality analyses of domestic water wells. Between 1991 and 1998, the BLM aggressively implemented the terms and conditions of NTL-MDO-91-1.

Based on nine years of data, the BLM has determined that methane contamination and loss of the hydrocarbon resource is more likely to occur at older conventional gas wells than in newer Fruitland Formation coalgas wells. This fact is a function of improved primary cementing requirements including circulation of cement through well-bore annuli from the producing horizon to the surface, thereby maximizing the potential for zonal isolation between the gas producing horizon and shallow aquifers.

NTL-MDO-91-1, Change 1 was implemented April 14, 1998. Change 1 decreased the required frequency of bradenhead testing to a biennial schedule (odd-numbered years) for Fruitland Coalgas wells with no history of aberrant bradenhead pressures.

As a result of monitoring to date, many gas wells exhibiting mechanical integrity problems identifiable by this process have been isolated and remediated or mitigated. These measures have reduced the potential for contamination of shallow groundwater aquifers and losses of hydrocarbon resources associated with natural gas production. The overall number of gas wells continuing to exhibit bradenhead pressure in excess of established thresholds has been significantly reduced. Test data suggest that similar continued monitoring can provide adequate control to assess changes.

II. DEFINITIONS

1) **Authorized Officer (AO)** shall pertain to the San Juan Field Office Manager.
2) A **conventional** gas well refers to a gas well completed in any sandstone reservoir, namely the sands of the Dakota, Mesaverde, and Pictured Cliffs horizons, or a gas well originally completed in one of these horizons and later re-completed in the Fruitland coal beds.
3) **A Fruitland CBM well** refers to a gas well originally completed in the coal seams of the Fruitland Formation.
4) **Critical Areas** were defined in 1994 as areas in which concentrations of methane equaled or exceeded 1.0 milligram per liter in groundwater drawn from domestic water well(s).

III. REQUIREMENTS

Change 2 to the Notice to Lessees-MDO-91-1 redefines the pressure threshold requirement for bradenhead sampling and analysis in the Ignacio-Blanco Field in Southwest Colorado(replacing Change 1) as follows:

1) **Annual bradenhead testing** is required for (1) **all conventional gas wells,** (2) all conventional gas wells **re-completed as Fruitland** Formation coal gas wells, (3) **all gas wells with remediation conditions of approval stipulating annual bradenhead tests.**

2) **Testing of all gas wells originally completed in the Fruitland Coal must be completed in the year drilled and in odd years** thereafter (2001,2003, 2005 etc).

3) **Samples will be required for analysis of bradenhead gas when the gas volume is sufficient to allow a minimum of 10 purges of the collection cylinder when pressures equal or <u>exceed 5 psig</u> in designated critical areas or 25 psig outside of designated critical areas.**

4) **Intermediate casing gas samples** will be required only when specifically requested by the authorized officer.

These requirements replace the threshold stipulated in Change 1, but do not revoke MDO-NTL-91-1 or MDO-NTL-91-1 Change 1. MDO-NTL-91-1-Change 2 amends the original requirement based upon the on-going testing and analysis efforts. These requirements will be enforced by the AO (BLM) until further notice. The BLM will continue to evaluate the effectiveness and efficiency of this program.

2/24/00

Calvin N. Joyner Date

San Juan Field Manager

WP:Q\dswanson\BH\NTL_91_1_chg2

Colorado IB-95-1

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
COLORADO STATE OFFICE

INFORMATION BULLETIN TO ALL FEDERAL AND INDIAN OIL AND GAS LESSEE/OPERATORS

Prevention of Potential Bird and Bat Mortalities
Caused by Production Equipment Design

Purpose:

To encourage oil and gas operators to prevent potential and unnecessary losses of birds and bats. Colorado BLM is notifying all oil and gas operators under a federal lease of this potential mortality situation that exists with open stacks on their production equipment (dehydrators and heater treaters).

Background:

Mortality of birds and bats associated with open exhaust stacks on production equipment is of concern to the Colorado Bureau of Land Management. Within the last year, BLM has been working with several oil and gas companies as well as requiring our petroleum inspectors to conduct informal inspections of production units to determine the extent of these potential losses. At this time, our Colorado information is nonconclusive as to the extent of these bird and bat mortalities from these open exhaust stacks. A few on-site examples (14) were conducted in the Rifle and Rangely areas by removing gas well exhaust stacks. In the Rifle area, bone remains of a bluebird were found in one unit. In addition, on-site visual inspections were made of gas well facilities over the state by petroleum engineering technicians. From these inspections (approximately 200 units), no bird or bat carcasses were documented.

However, reports from different sources in New Mexico conclude that a problem does exist and is one of great concern. Different sources from BLM offices in New Mexico have reported losses of birds from being trapped inside fired units of gas wells. Cavity nesting birds such as mountain bluebirds and flickers, along with finches and shrikes were most often found in exhaust stacks. Results of volunteer surveys by industry and random sampling by BLM have shown that bird loss was occurring. Information provided by different gas companies varied greatly. Bird mortality reported varied from a small percentage of well locations to finding several birds at a single location. The information gathered did show that losses were generally occurring throughout the San Juan Basin and in Southeastern New Mexico. Equipment on a total of 2,500 wells was examined and results reported to BLM were that 252 birds and bats were found. Bird losses were more concentrated towards equipment that was fired intermittently.

Recommended Action:

Because many uncontrollable factors are contributing to the decline of several species of

migratory birds, there is one factor that BLM and the oil and gas industry can control through discouraging birds and bats from entering exhaust stacks. This can be accomplished by covering the exhaust sack with a screen or other excluder devices to discourage birds and bats from entering, perching, and nesting on stacks. These preventative measures by industry would improve the environment for birds and bats.

Responsibility:

BLM is mandated to prevent unnecessary loss of wildlife including birds and bats through actions implementing resource programs. Owners of production equipment operating under a federal lease are responsible for preventing loss of birds and bats. Irresponsible parties could be in violation of the Migratory Bird Treaty Act subject to financial penalties enforced by the U.S. Fish and Wildlife Service. Under the Migratory Bird Treaty Act, any take of birds (causing death) is considered a violation of the Act and enforced by the U.S. Fish and Wildlife Service. Migratory birds protected by the Migratory Bird Treaty Act are listed in 50 C.F.R. 10.13.

Future Action:

BLM will continue to evaluate the potential mortality problem through our routine oil and gas inspection program of facilities. Any escalation of this potential problem may result in requiring operators to provide protective measures on exhaust stacks.

If you need additional information or have questions, please contact Pat Gallagher at (303) 239-3756 or contact the lc

Date: January 30, 1995 Signed: Dave Strunk,
Deputy State Director,
Resource Services

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SOUTHERN UTE INDIAN TRIBE

GENERAL WELL SITE CONDITIONS OF APPROVAL

COMPANY: ______________________________ DATE: ______________

WELL NAME: ____

LOCATION: Section _______, T______N, R________W, N.M.P.M., La Plata County, Colorado,

________ feet from the N/S line, and _______ feet from the E/W line.

****

<u>Boldface and underlined text denotes site specific conditions.</u>

****

1. A preliminary onsite review of new gas and/or oil well pads and access roads by Tribal, BIA, BLM, and archaeological representatives is required.

2. All surface disturbance shall be confined to the 13 point surface use plan submitted with the Application for Permit to Drill (APD). All land-altering activity outside the surface use plan will require permission by the Energy Department. A copy of the APD and these conditions of approval shall be kept on location at all times.

3. All activity shall be confined to the areas surveyed for cultural resources. If subterranean cultural resources are encountered, all land-altering activities shall be halted and the following shall be notified immediately:

   Southern Ute Energy Department - (970) 563-0140
   BIA Area Archaeologist - (505) 766-3374
   BIA Southern Ute Agency - (970) 563-4514

   The operator will inform all people who are in the area that they are subject to prosecution for disturbing archaeological sites or picking up artifacts.

4. The gas and/or oil well pad shall be properly identified with a permanent readable sign, which shall include:

   Company name
   Well name
   Legal description
   Lease Number

5. All drilling and completion rigs shall be escorted by pilot cars when traveling on all roads on the Southern Ute Indian Reservation.

6. Construction of the gas and/or oil well pad and/or access road shall come to a halt during inclement weather to prevent soil damage or destruction.

7. **<u>A BUREAU OF INDIAN AFFAIRS TIMBER CUTTING PERMIT, FORM 5-5331 AND LOAD TICKETS MUST BE OBTAINED PRIOR TO CUTTING TREES. THIS PERMIT CAN BE OBTAINED FROM THE TRIBAL FORESTRY (970) 563-4571.</u>**

a) The cleared area is to be kept to the minimum necessary for drilling operations.

b) Chainsaws shall be used to cut trees. Trees shall not be pushed by bulldozers or other heavy equipment.

c) All sound woody material, including deadwood, from piñon pine, juniper, and gambel oak which is at least three (3) inches in diameter and two (2) feet in length will be salvaged during clearing activities.

d) All juniper suitable for posts shall be cut into seven (7) foot lengths, and all other wood material will be cut into eighteen (18) inch lengths, limbed, and hauled to the Tribal wood yard located north of the Custom Farm Tribal Shop, Monday through Friday, between the hours of 8:00 A.M. and 4:30 P.M., except on holidays. All wood shall be hauled prior to the arrival of the drilling rig. Load tickets must accompany each load hauled to the wood yard.

e) Debris (slash) from forest products, which includes brush, limbs, and wood products not meeting the minimum size, will be chipped with a wood chipper and scattered around the location within seven (7) days after completion of construction. Stumps shall be stockpiled and disposed of in the reserve pit when it is being reclaimed.

f) The wood volume has been determined to be _____ cords and ______ posts.

8. The access road will be constructed on the flagline location previously approved.

9. The reserve and water pits will be lined with sufficient reinforced liner to prevent leakage.

10. The reserve and water pits shall be fenced on three sides prior to the arrival of the drilling rig. The fourth side will be fenced immediately after the rig leaves the location. The fence shall be 4-wired barbed wire with "H" braces. Wire spacing from the ground shall be 12", 12", 10" and 8", with the top wire 42" from the ground. This fence shall be maintained until the pits are reclaimed.

11. The reserve pits will be allowed nine (9) months for evaporation. The 9-month period shall begin on the spud date. Any fluids remaining after nine (9) months shall be disposed of in a manner consistent with Federal Regulations. The pits will then be filled with dirt material, leveled, and reclaimed.

12. Reserve pits with torn liners shall immediately be reclaimed.

13. Neither burn pits nor blow pits shall used for storage or disposal of fluids.

14. The reserve pit shall have a minimum of four (4) feet of freeboard at all times. Freeboard shall be measured from the top of the pit liner to the surface of the water in the reserve pit.

15. If a gas and/or oil well is abandoned or suspended, all pits must be immediately fenced until they are backfilled. No pits shall be left open for longer than nine (9) months.

16. Water, mud, and drilling fluids will not be transferred to other gas and/or oil well locations or reserve pits without prior approval. The BLM, Southern Ute Energy Department and/or BIA Realty personnel will make compliance checks.

17. All topsoil will be stockpiled neatly for reclamation purposes.

18. Topsoil will not be piled against trees or deposited in natural drainageways.

19. All fences and gates that are torn down or removed will be repaired or rebuilt to the original standard of construction within seven (7) days after the drilling rig leaves the location.

20. Culverts will be installed in areas where needed or required.

21. Culverts or cattle guards will not be removed unless authorized by the Tribe.

22. To prevent livestock access, the entire gas and/or oil well location may be permanently fenced with 4-wire barbed wire fence constructed with "H" braces at the corners. Line posts shall be spaced 1 rod (16.5') apart. Wire spacing from the ground shall be 12", 12", 10" and 8", with the top wire 42" from the ground. There shall be at least one livestock gate in the fence. The fence shall be completed within seven (7) days after the drilling rig leaves the location. **An alternative to fencing is to build welded pipe barriers around all well site items requiring protection from livestock. These barriers should be anchored in concrete and painted environmental green.**

23. If the gas and/or oil well site is fenced, 16-foot heavy duty cattle guard, eight (8) feet in width and with six (6) inch spacing between bars will be installed at the entrance of the well pad. The cattle guard shall be installed within seven (7) days after the drilling rig leaves the location. A livestock tight gate may be substituted for a cattle guard. The well site operator is responsible for maintenance of the cattle guard or the gate.

24. Trash will not be allowed to accumulate on the gas and/or oil well site. All materials, trash, junk, debris, etc. not required for production shall be disposed of at an approved landfill within seven (7) days after said well has been completed.

25. No trash shall be disposed of in the reserve pit.

26. Trash shall not be burned.

27. Misters on blooie lines shall be used when drilling with air or gas. Operators shall be responsible for cleaning dust off vegetation if required by the Energy Department. Contact the Energy Department at (970) 563-0140 for authorization of cleaning procedures. Additional surface damage compensation and reclamation may be required.

28. Within six (6) months upon completion of the drilling and completion operations, those areas of the wellpad not used on a daily basis, or needed for future reworking operations, will be recontoured and revegetated. Unless otherwise specified, seed varieties and drilled seeding rates shall be as below. For broadcast seeding, double the rates specified.

Mix #1 North facing escarpment of Mesa Mountains and North

Arriba Western Wheatgrass	3 PLS pounds/acre
Ladak Alfalfa	1 PLS pounds/acre
Antelope Biterbrush	1 PLS pounds/acre
Luna Pubescent Wheatgrass	3 PLS pounds/acre
Delar Smal Burnet	1 PLS pounds/acre
Paloma Indian Ricegrass	2 PLS pounds/acre
Total	**11 PLS pounds/acre**

Mix #2 Mesa Mountains Plateau and higher elevations north of Picnic Flats area

Arriba Western Wheatgrass	3 PLS pounds/acre
Luna Pubescent Wheatgrass	3 PLS pounds/acre
Manchar Smooth Brome*	3 PLS pounds/acre
Ephraim Crested Wheatgrass	2 PLS pounds/acre
Ladak Alfalfa	1 PLS pounds/acre
Total	**12 PLS pounds/acre**

Mix #3 West of Highway 550

Arriba Western Wheatgrass	5 PLS pounds/acre
Lovington Blue Grama	2 PLS pounds/acre
Paloma Indian Ricegrass	3 PLS pounds/acre
Ephraim Crested Wheatgrass	2 PLS pounds/acre
Total	**12 PLS pounds/acre**

Tribal personnel will make periodic checks of seeding success. If within one year no visible strand or only a partial stand is observed, additional seeding shall be required.

29. No fluids (i.e., diesel, motor oil, water, etc.) will be disposed of on the Southern Ute Indian Reservation, except as otherwise specifically authorized.

30. Access roads and gas and/or oil well pads will be maintained in accordance with generally accepted standards for repair, orderliness, neatness, sanitation, and safety.

31. All personnel, vehicles, and equipment will be confined to the access roads and gas and/or oil well pads.

32. Ample notification shall be given to the Tribe at (970) 563-0140 when construction will hamper ingress and egress to Tribal land.

33. All spills, fires, accidents or any other unusual occurrence shall be promptly reported to the Southern Ute Energy Department at (970) 563-0140 and BIA Realty Office at (970) 563-4514.

34. Construction, drilling, and production of the proposed gas and/or oil well will be monitored by BLM, Tribal and/or BIA representatives.

35. Special conditions or additional stipulations will be issued for situations outside these General Well Site Conditions of Approval.

36. Surface damage compensation will be paid to the Southern Ute Indian Tribe at a rate determined by the Southern Ute Energy Department as stated in the Tribal Council Policy regarding right-of-way and surface damage compensation.

37. All production equipment shall be muffled.

38. All static equipment shall be painted an environmental green color within seven (7) days of completion of construction.

39. **COMPANY NAME** shall give the Southern Ute Energy Department advance notice at least 48 hours before construction is to begin.

40. Adequate weed control will be maintained on the wellpad and access road at all times during the life of the project until final reclamation of the wellsite and access road is achieved.

41. On Fruitland formation cavitation procedures, any off location vegetation that gets "dusted" by coalfines needs to be washed off with cold water within 48 hours of cavitation completion. The Operator will contact the BIA and BLM immediately so that the washing process can be monitored by them.

SIGNED: ______________________ DATE: November 21, 2001
Petroleum Land Manager

CONCURRED: ______________________ DATE: ______________
Realty Officer

CONCURRED: ______________________ DATE: ______________
Superintendent

SOUTHERN UTE INDIAN TRIBE

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GENERAL PIPELINE RIGHT-OF-WAY STIPULATIONS

COMPANY: ________________________________ DATE: November 21, 2001

LINE NAME: ________________________________

LOCATION: Section(s) _____, T_______N, R______W, N.M.P.M., La Plata County, Colorado

****

Boldface and underlined text denotes site specific stipulations.

****

1. A preliminary onsite review of the pipeline right-of-way by Tribal, BIA and archaeological representatives is required.

2. Construction will conform to the requirements as described on the Right-Of-Way Application. A copy of these stipulations shall be kept on location at all times.

3. A preliminary survey plat shall be submitted to the SUIT Energy Department at P.O. Box 737, Ignacio, Colorado 81137 at least five (5) days prior to the onsite inspection, and an "as built" survey plat shall be submitted to the Energy Department within thirty (30) days following completion of construction.

4. Surface damage compensation and/or right-of-way grant of permission assessment will be paid to the Southern Ute Indian Tribe at a rate determined by the SUIT Energy Department as stated in the Tribal Council Policy regarding right-of-way and surface damage compensation for oil and gas facilities. All assessments shall be paid prior to construction.

5. Special and/or additional stipulations will be issued whenever conditions warrant requirements outside the General Pipeline Right-Of-Way Stipulations.

6. All activity shall be confined to the areas surveyed for cultural resources. If subterranean cultural resources are encountered, all land-altering activities shall be halted, and the following shall be notified immediately:

SUIT Energy Department - (970) 563-0140
BIA Area Archaeologist - (505) 766-3374
BIA Southern Ute Agency - (970) 563-4514

All people who are in the area will be informed by the operator that they are subject to prosecution for disturbing archaeological sites or picking up artifacts.

7. **The centerline of the pipeline shall be restaked prior to construction. The edges of the right-of-way shall be staked in 100 foot intervals prior to construction.**

8. **____________ will provide timely written notice to the La Plata County Assessor, with a copy provided to the Land Division of the SUIT Energy Department, of the commencement of the installation or construction of the above named right-of-way and the completion of the installation or construction of said right-of-way. The form of notice is attached as Exhibit "A".**

9. **An archaeology survey has identified ____ sites eligible for nomination to the National Register of Historic Places. These sites are identified by #'s as shown on the attached plats. These site boundaries, shall be fenced prior to the beginning of construction and a qualified archaeologist shall be present during all earth disturbing activities within 100 feet of this site, including the installation of the fencing.**

10. Ample notification shall be given to the Tribe at (970) 563-0140 when construction will hamper ingress and egress to Tribal lands.

10. Warning signs and reflectors indicating construction underway will be erected where applicable.

11. Construction of the pipeline shall come to a halt during inclement weather to prevent soil damage or destruction.

12. All personnel, vehicles, and construction equipment will be confined to the right-of-way.

13. Construction of new permanent access roads will not be permitted.

14. The pipeline shall be laid below the bed of any ravine, canyon or waterway it crosses.

15. Blading of pipeline routes located on gentle topography need only to have brush and surface irregularities removed and smoothed, leaving most of the underlying layer of vegetation undisturbed. Graders are recommended for clearing these routes, because blade depths can be more easily controlled.

16. **A BUREAU OF INDIAN AFFAIRS TIMBER CUTTING PERMIT, FORM 5-5331 AND LOAD TICKETS MUST BE OBTAINED PRIOR TO CUTTING TREES. THIS PERMIT CAN BE OBTAINED FROM THE TRIBAL FORESTRY (970) 563-4571.**

    a) The cleared area is to be kept to the minimum necessary for construction and maintenance.

    b) Chainsaws shall be used to cut trees. Bulldozers or other heavy equipment shall not be used to clear areas.

    c) All sound woody material, including deadwood, from piñon pine, juniper, and gambel oak, which is at least three (3) inches in diameter and two (2) feet in length will be salvaged during clearing activities.

    d) All juniper suitable for posts shall be cut into seven (7) foot lengths and all other wood material will be cut into eighteen (18) inch lengths, limbed, and hauled to the Tribal wood yard located north of the Custom Farm Shop, Monday through Friday, between the hours of 8:00 A.M. and 4:30 P.M., except on holidays. All wood shall be hauled prior to completion of construction. Load tickets must accompany every load hauled to the wood yard.

    e) Debris (slash) from forest products, which includes limbs, brush, and wood products which do not meet the minimum size, will be chipped with a wood chipper and scattered around the location within seven (7) days after completion of construction.

    f) Stumps shall be cut as low as practical to avoid waste. The mean height of any stump shall not exceed one half its diameter, and in no case shall it exceed fourteen (14) inches on the uphill side. Stumps which are grubbed during construction shall be scattered at least fifty (50) feet from the right-of-way within seven days after completion of construction.

    ~~g) The wood volume has been determined to be _____ cords and _____ posts.~~

17. Surface soil material shall be stockpiled to the side of the routes where cuts and fills or other surface disturbance occur during pipeline construction. Surface soil shall not be mixed or covered with subsurface material.

18. Cuts and fills on pipelines should be made only where necessary. Cut and fill slopes should normally be no steeper than 3:1 and should be graded to blend with the adjacent terrain.

19. Rock which is brought to the surface during construction will normally be buried on site. The amount of surface rock will not be greater than the pre-disturbance condition of the site.

20. After backfilling of the ditch, final leveling will be done and the proper crown constructed to allow for settling of the trench. These trenches should be maintained in order to correct settlement and to prevent erosion.

21. All road crossings shall be compacted to avoid excessive settling.

22. Pipeline routes should be recontoured to conform to the adjacent terrain, water barred, and reseeded.

23. Frequency of water bar spacing will be dependent on the slope of the land as shown below:

percent of slope	spacing interval in feet
0 to 5	0
6 to 10	200 (only on slopes longer than 500 feet)
10 plus	50

Water bars will be started and finished in vegetation and constructed at grades of 2% or less. Water bars should be repaired as necessary.

24. Upon completion of the right-of-way, disturbed areas will be recontoured and revegetated. Unless otherwise specified, seed varieties and drilled seeding rates shall be as below. For broadcast seeding, double the rates specified.

Mix #1 North facing escarpment of Mesa Mountains and North

Arriba Western Wheatgrass	3 PLS pounds/acre
Ladak Alfalfa	1 PLS pounds/acre
Antelope Biterbrush	1 PLS pounds/acre
Luna Pubescent Wheatgrass	3 PLS pounds/acre
Delar Smal Burnet	1 PLS pounds/acre
Paloma Indian Ricegrass	2 PLS pounds/acre
Total	**11 PLS pounds/acre**

Mix #2 Mesa Mountains Plateau and higher elevations north of Picnic Flats area

Arriba Western Wheatgrass	3 PLS pounds/acre
Luna Pubescent Wheatgrass	3 PLS pounds/acre
Manchar Smooth Brome*	3 PLS pounds/acre
Ephraim Crested Wheatgrass	2 PLS pounds/acre
Ladak Alfalfa	1 PLS pounds/acre
Total	**12 PLS pounds/acre**

Mix #3 West of Highway 550

Arriba Western Wheatgrass	5 PLS pounds/acre
Lovington Blue Grama	2 PLS pounds/acre
Paloma Indian Ricegrass	3 PLS pounds/acre
Ephraim Crested Wheatgrass	2 PLS pounds/acre
Total	**12 PLS pounds/acre**

First seeding shall be done within six (6) months of completion of the right-of-way. Tribal personnel will make periodic checks of seeding success. If within one year no visible strand or only a partial stand is observed, additional seeding shall be required.

25. All existing fences removed for construction purposes will be repaired or rebuilt.

26. All existing ditches shall be rerouted or restored to pre-construction conditions.

27. The centerline of the pipeline shall be permanently staked with pipeline location stakes. The company name and telephone number shall be placed on each stake.

28. All trash or litter on the right-of-way will be disposed of at an approved landfill when construction operations have been completed.

29. No fluids (i.e., diesel, motor oil, crankcase oil, etc.) will be disposed of on the Southern Ute Indian Reservation. Discharge permits (e.g., NPDES) shall be obtained for hydrostatic water disposal.

30. Pumping stations should be kept in a neat and well maintained condition.

31. A final inspection of the right-of-way by representatives of the Southern Ute Indian Tribe and the Bureau of Indian Affairs will be done once construction has been completed.

32. ______________shall give the SUIT Energy Department (970.563.0140) at least 48 hours advance notice before construction is to begin.

33. ______________shall be responsible for upkeep and maintenance of the right-of-way on an "as needed" basis.

34. The completed pipeline ROW shall not be used as a road without written authorization by the Tribe.

35. Adequate weed control will be maintained on the right-of-way at all times during the life of the right-of-way.

SIGNED: ______________________________ DATE: November 21, 2001

Petroleum Land Manager

CONCURRED: ______________________________ DATE: ______________

Realty Officer

CONCURRED: ______________________________ DATE: ______________

Superintendent

EXHIBIT "A"

LA PLATA COUNTY
PIPELINE/FACILITY NOTIFICATION FORM

Intended to comply with taxation compact between the Southern Ute Tribe and La Plata County.

Send to: La Plata County – Tax Assessor
Craig Larson
Post Office Box 3339
Durango, Colorado 81302

1. Company Name: ______________________________
   Contact Person Name: ______________________________
   Address: ______________________________
   Phone Number: ______________________________

2. Facility Name: ______________________________

3. Legal description of location: _____ Sec. _____ Twn. ____ Range

4. Site plan (for facility) attached __________

5. Estimated cost of pipeline or facility or both ______________________

6. Estimated date of commencement ______________________
   Estimated date of completion ______________________

Position/title of person completing form ______________________________

Name ____________________ Signature ____________________ Date ____________

cc: Southern Ute Indian Tribe
Energy Department – Land Division
Post Office Box 737
Ignacio, Colorado 81137

[illegible]

Total [illegible]

[illegible] seeding shall be done [illegible] observed, additional seeding shall be required.

25. All existing fences removed for construction purposes will be replaced [illegible].

26. All existing utilities shall be repaired or restored to pre-construction conditions.

27. The centerline of the pipeline shall be permanently staked with pipeline location stakes. The company name and telephone number shall be placed on each stake.

28. All trash or litter on the right-of-way will be [illegible] have been completed.

29. No fluids [illegible] will be disposed of on the Southern Ute Indian Reservation. Discharge permits (e.g. NPDES) shall be obtained for [illegible] water [illegible].

30. Pumping stations should be [illegible] well maintained condition.

31. A final inspection of the right-of-way by representatives of the Southern Ute Indian Tribe and the Bureau of Indian Affairs will be done once construction has been completed.

32. ______________ shall give the SUIT Energy Department [illegible] before construction is to begin.

33. ______________ shall be responsible for [illegible] date.

34. The completed pipeline ROW shall not be used as a road without written authorization by the Tribe.

35. Adequate weed control will be maintained on the right-of-way [illegible] the life of the [illegible].

SIGNED: ______________ DATE: ______________
Petroleum Land Manager

CONCURRED: ______________ DATE: ______________
Realty Officer

CONCURRED: ______________ DATE: ______________
Superintendent

Residual impacts are those which remain after reclamation of abandoned wells, facilities and roads. They would consist primarily of small areas which would not successfully revegetate. There is no way of estimating total acreage which would not return to native vegetation. However, the significance of this impact in relation to the value of the oil/gas extracted is considered very small.

Visual impacts of wells, facilities and pipelines places in areas of extreme topogr for an unknown period of time.

The additional 400-500 new wells predicted to be drilled over the next 20 years very small contribution to cumulative impacts on the Southern Ute Indian Reserv additional 400-500 wells seem to be a major impact, the impact is expected to the following reasons: 1. The oil and gas exploration, development and produ existing areas of development or adjacent to such areas, and 2. Those areas outside of previously disturbed areas will constitute very small acreage development.

Alternative B, the No Action Alternative has been discounted due to the fact that it v the Tribe from developing its natural resources for the benefit of its members.

The selection of Alternative A (full development) over Alternative C (limited or restricted development) is based upon the conclusion that the cumulative impacts of these alternatives are basically the same (see Evaluation and Comparison of Alternatives on page 8). Under Alternative B, though parts of the reservation that would be restricted would be restricted due to archeological, cultural, historical, human or environmental concerns. It has been determined that the present federal regulations in place adequately protect the archeological, historical and cultural resources. The federal government through its field agencies (BIA, BLM, USFW, EPA, etc.) are responsible for the protection of the environment and other resources of the Tribe. With the implementation of all mitigation measures as described within this EA and the enforcement of federal regulations and laws by those federal agencies responsible for such enforcement, the selection of alternative A will allow the Tribe to develop their mineral resources while at the same time protecting the other resources that will be affected by this action.

The primary source of revenue for the Southern Ute Tribal Government is the oil and gas operations and enterprises on Tribal lands. Proper management of the Tribe's resources will assure prosperity and an environmentally sound reservation in the future.

V. MITIGATION From 1990 BIA Environmental Assessment for the Southern Ute Indian Tribe

Post lease/permit/mineral agreement mitigation is implemented through stipulations attached to the lease/permit/mineral agreement and the site-specific environmental documentation (i.e., APD, specific seismic permit EA, Right-of-Way EA). As impacts are identified in the site specific environmental documentation, changes in the proposal are considered and implemented if possible: pads are rotated to avoid major cuts and fills, corners of pads are rounded to avoid large cuts, pads and roads are moved to avoid archaeological sites, pads and roads are moved to take out a minimum of trees, locations are moved to save rangeland, locations are moved to

use existing nearby pads and roads, steep hillsides are avoided when feasible, tree screens are left in place to hide locations from distant viewing, existing operable stockponds are left undisturbed, riparian and wetlands are avoided at almost all costs and reserve pits are prohibited near such areas (steel tanks substitute), locations are moved away from nearby residences, locations and access roads are moved so that irrigated fields are not unduly disrupted, major drainages are protected by adequate culverts or bridges, locations are protected from floodwaters by adequate drainage ditches around the location and reserve pits, 6 to 8 inches of topsoils are required to be stockpiled for use in later reclamation of the wellpad, proposed wellpads and reserve pits are reduced in size where applicable, and timber is required to be salvaged by cutting into post and firewood lengths with slash to be chipped and scattered.

In addition to site-specific Tribal stipulations being attached to each lease/permit/minerals agreement as conditions of approval for surface use, in those instances where subsurface archaeology is suspected, archaeological monitoring is required for all initial surface disturbing activity. Also required is 48 hour notification to the Tribe, BIA, and BLM prior to initial surface disturbing activity so that this work can be monitored.

A general mitigation recommendation is that a comprehensive monitoring program be developed for the reservation, by BIA and BLM, to assess the effectiveness of mitigation in the oil and gas program.

Although well pad dimensions vary, an average size is 300 feet long by 250 feet wide, disturbing about 1.7 acres. An average new access road would be about 300 feet long and 20 feet wide, disturbing an additional 0.2 acre. Associated pipelines would parallel existing roadways for an additional disturbance of 0.2 acre. This totals to about an average of 2 acres surface disturbance for each new well.

On any given site, the order of construction is:

1. Remove all salvageable wood products for fence posts and firewood.

2. Chip and scatter all slash material (limbs and small branches).

3. Strip and stockpile 4 to 6 inches of topsoil.

4. Construct wellpad, reserve pit, and access road.

The drill rig is moved onto location and drilling operations begin. Upon completion of drilling, well casing is set, and drill rig moves out.

A smaller drilling rig (completion rig) moves on location to complete the well (usually perforates the casing in the production zones, fractures the producing formations if needed, and sets production tubing).

Generally, after the completion rig moves off location, production equipment (heater treaters, dehydration units, water and/or oil storage tanks, compressor units, and meter runs) are set up and made operational. Pipelines are constructed to the well site so that produced gas and

produced water can be removed from location.

When the reserve pit is dry, it is reclaimed (filled in, contoured, topsoil spread, and reseeded), and those portions of the wellpad not needed for production are also reclaimed.

When the well is exhausted, it is plugged downhole with cement, all surface equipment is removed, and a dry hole marker is placed over the wellbore. Stockpiled topsoil is spread across the wellpad and reseeded, and the access road is reclaimed by similar procedures.

A. Minerals

No additional mitigation measures are required.

B. Soils

Reclamation and erosion control measures can be used to mitigate high to low levels of impacts on soils resulting from construction and operation of proposed facilities. The following mitigation measures should be employed on a site/soil-specific basis. Soils that are identified as being susceptible to high levels of impact. Those occupying steep slopes, have high susceptibility to erosion, and/or being poorly suited for reclamation/revegetation should receive particular emphasis. Possible measures to minimize disturbance, stabilize disturbed soil materials to reduce soil loss due to erosion, revegetate disturbed areas and restore soil productivity during and following facility construction are:

1. Selective salvage and replacement of topsoil for agricultural lands and those lands for which the landowner requests that topsoil be salvaged and replaced.

2. Construction or placement of erosion control features to limit the steepness and length of slope (e.g., water bars, terraces, rip rap, sand bags, or straw bales for temporary control).

3. Grading of disturbed areas to contour.

4. Soil which has been excavated during construction and not used should be evenly backfilled into the cleared area or removed from the site. The soil should be graded to conform within the terrain and the adjacent land.

5. Dumping of excess material or material on downhill slopes should be minimized.

6. Replacement of earth adjacent to water crossings should be at slopes less than the normal angle of repose for the soil type involved.

7. Cut and fill slopes should be rounded to break sharp unnatural edges formed at the contact point between the constant-pitch out-slope and the rounded

natural landform (BLM, 1982).

8. Preparation of the surface soil to receive seed, including ripping/chiseling, surface roughing and tilling across slope.

9. Seeding with a seed mixture of adapted grass or other plant species approved by BIA.

10. Addition of soil amendments, including fertilizer, and use of appropriate seeding methods (e.g., drill seeding and broadcast seeding) to aid in the development of a positive growth medium.

11. Mulching with straw, hay or wood fiber.

12. Crimping of hay or straw mulch on the contour into the soil or tacking netting over an organic mulch on steeper, more erodible slopes to hold the mulch, soil and soil moisture.

13. Monitoring of disturbed areas to identify potential soil instability or erodible areas and to implement the necessary mitigation measures to restabilize the soils.

14. Mandatory control of noxious weeds on all disturbed areas.

Reclamation and revegetation will be done as rapidly as possible to protect the soil.

No surface disturbance will be allowed in areas with slopes exceeding 25 percent unless the lessee/operator and BIA arrive at an acceptable plan for mitigation of anticipated impacts. The plan must be prepared prior to development of the site and will become a condition for approval when authorizing the action.

C. Water Resources

Potential mitigation measures for surface and ground water resources are grouped together based on their interdependence, but have been divided into six categories: general, construction, operation, control measures, monitoring and spills. The potential mitigation measures are presented below.

<u>General</u>

1. Ensure that all applicable water quality standards are met.

2. In accordance with existing regulations, monitoring and mitigation of injected water remains under EPA control (a permit for a disposal well is required from EPA).

Construction

1. Witness casing cementing to ensure that the fresh water zones are protected.

2. Avoid construction activities near or through irrigation systems during the growing season.

3. Minimize time of construction and any temporary water diversions and revegetate as quickly as possible.

4. Avoid construction activities near or through streams during high flows or rainfall events.

5. For road and pipeline stream crossings, minimize the time and area of disturbance and stabilize immediately.

6. Cathodic protection wells monitored and placed in deeper zones to protect fresh potable water zones and cement other zones.

7. Divert all surface runoff around facilities.

8. Utilize special erosion control measures for all well pads cut into hillslopes.

9. Route surface runoff from drilling locations into reserve pits.

10. Use fabric filter of various types as appropriate, to reduce erosion and sedimentation.

11. Well pits should be placed on the upslope (cut) portion of the pads.

12. All pits on Fruitland wells will be sealed or lined.

13. Stay out of floodplains -- Floodplains Protection Act.

Operation

1. Use care when conducting fuel or chemical transfers within 0.25 mile of streams, rivers, ponds or lakes.

2. Place strict control on materials placed in reserve pits used for drilling.

3. Since snowmelt can contribute significant material input into streams, contain all spills during winter months.

Control Measures

1. Riprap stream beds as needed for road (culvert) crossings of ditches and streams.

2. Maintain or seed vegetation on runoff ditches.

3. Riprap stream beds and seed vegetation as needed.

4. Gravel all roads that have heavy truck traffic.

Monitoring

1. Sample and analyze water quality of produced water on a routine basis.

2. Conduct site inspections during periods of high rainfall, runoff and stream flow to evaluate potential effects of erosion, sedimentation, leaks and spills.

3. Conduct routine maintenance checks and site inspections of facilities to examine for potential erosion problems and spills or leaks.

4. For buried produced water pipelines, provide control/evaluation to ensure no leakage is occurring.

5. Monitor injection wells for integrity and compliance.

6. Witness casing and plug and abandon cementing jobs.

Spills

1. Develop and implement a Spill Contingency and Response Plan, including specific containment, clean-up and mitigation procedures.

2. Provide spill control measures.

D. **Wildlife**

In addition to the use of good construction practices, implementation of the following mitigation measures is recommended:

1. Compliance with regulatory requirements of the U.S. Fish and Wildlife Service and other relevant resources management agencies.

2. If practicable, avoid conducting exploration, development or production operations in important wildlife habitat types.

3. If practicable, avoid conducting activities during wildlife critical use periods in important habitat types.

4. Revegetate all disturbed areas following disturbance according to BIA requirements.

5. Conduct work in streams in a manner that minimizes siltation and erosion, including minimization of areal and temporal disturbance, and use of specific control measures.

6. If practicable, avoid placement of facilities in habitat that support special plant species and sensitive and valuable vegetation types, including wetland/riparian areas.

7. Limit construction clearing in woodland areas to trimming or crushing whenever possible.

8. During construction in shrubland and woodland areas, pile some of the cleared or clipped vegetation from construction areas in small thickets located off of the area to provide cover for displaced animals.

9. Utilize erosion controls during construction activities.

10. Limit off-road vehicle use.

11. Prohibit the use of firearms to reduce potential poaching activities by workers.

12. Complete revegetation of disturbed areas with fast-growing plant species as appropriate for short term soil stabilization.

13. Control dust during operations.

14. Avoid placement of construction lay-down areas at stream crossings, and wetland/riparian and other sensitive areas.

15. Install pipelines in a manner to restore the topsoil and associated seed source when backfilling.

16. Minimize the spread of noxious weeds with annual mandatory control measures.

17. Potential adverse construction impacts to streams and irrigation ditches and rivers may be significantly reduced by completing during periods of little or no flow.

18. Minimize erosional processes at streams and river crossings by stockpiling trench spoils above full-bank elevations.

19. Stabilize excess material at streams and rivers in place or remove off-site.

20. Place pipe below channel scour depths in streams and rivers to avoid partial diversion of channel discharges.

21. Complete fueling and lubrication away from aquatic environment.

22. Periodically check all equipment for leakage to avoid spills. Employ off-site mitigation where needed to compensate for habitat lost to oil and gas development.

    The basic premise of off-site mitigation is that the impacts from oil and gas development extends beyond the immediate area of surface disturbance. Therefore in order to compensate for the reduction of habitat quality caused by the development, habitat improvements are conducted elsewhere to increase habitat values to offset values lost.

E. Vegetation

Existing stipulations provide for the reclamation of disturbed areas. Increased monitoring is required to determine if reclamation is successful.

Some general stipulations for minimization of disturbance:

1. During construction, clearing of land for facilities or structures should create curvilinear boundaries instead of straight lines and minimize disturbance of the landscape (BLM, 1982). Grading should be done in a manner which will minimize erosion and conform to the natural topography (USFS, 1977).

2. The clearing of trees and vegetation for oil and gas facilities should be limited to the minimum area required. Feather and thin edges of vegetation.

3. To the extent possible, all foliage adjacent to the site should remain undisturbed to provide maximum screening of the facility.

4. Brush or small trees cleared and not otherwise disposed of may be spread in a way to provide cover habitat for small animals, reptiles and birds. Woody materials should be randomly placed particularly in downslope fill areas to conform to adjacent vegetation patterns. It should be noted that material larger than 6" will provide breeding areas for bark beetles.

5. All timber and other vegetation material without value should be mechanically chipped and spread in a manner that will aid seedling establishment and soil stabilization.

F. Forestry

In woodland areas all exploration, development and production sites are to be regenerated (or portion thereof) as work is completed.

G. Air Quality

Mitigation measures:

1. Require a mister on the Blooie line.

2. Require an ignitor on the Blooie line.

H. Resource Use Patterns

Mitigation measures:

1. Comply with all BIA, BLM and tribal lease/permit/mineral agreement requirements concerning general agricultural and other land use issues.

2. Avoid placement of oil/gas facilities in areas of irrigated agriculture to the maximum extent possible.

3. Locate facilities on the edges of irrigated and non-irrigated agricultural lands to the maximum practicable extent to reduce direct and indirect effects on agricultural resources and operations.

4. Minimize crossings or other direct effects on agricultural irrigation facilities, including water canals, ditches, pipelines and other water conveyances to the maximum practicable extent.

5. If irrigation and other agricultural (e.g., fences, gates) facilities are damaged, repair or replace the facilities according to landowner requirements.

6. Minimize oil/gas-related construction equipment movement off specific access roads to avoid disturbance of agricultural and other lands.

7. Repair, maintain and gravel all access roads used for project related traffic.

I. Threatened and/or Endangered Species

Current stipulations as applied are adequate to protect Federal threatened or endangered species as no actions are allowed which would result in a Section 7 "jeopardy opinion". All site specific environmental documents will address protection for all known habitat of threatened and/or endangered (T/E) species on the reservation.

J. Socioeconomic

Given the positive socioeconomic effects of the project, mitigation, enhancement and protective measures are not pertinent. An effort will be made to use the Tribal work force and local materials and supplies whenever possible.

K. Archeological

The Albuquerque Area Office, BIA, policy with regard to compliance with Section 106 of the National Historic Preservation Act and the Archeological Resources Protection Act will

be adhered to prior to specific oil and gas development activities. This includes Application Permit to Drill (APD), access roads, pipelines, gathering systems, re-injection wells, waterlines, compressor stations, storage tanks, and all other related activities. The third party applicants will provide for all cultural resources surveys of project areas of impact to identify cultural resources. This will include acceptable reports of these surveys. All activities necessary to protect, monitor or test identified sites will be provided by the applicant. The report review and compliance process will be completed by the Albuquerque Area Office.

All known cultural resources will be protected by providing a buffer zone, and if necessary, temporary protective fencing will be placed around a portion of identified sites. Operators who damage sites outside of designated project areas or right-of-ways, or who fail to take proper site avoidance measures as prescribed, may be subject to civil penalty assessments for site damages under the provisions of the Archeological Resources Protection Act. If any previously unidentified cultural resources are encountered during construction activities, then all work in the immediate vicinity of the find must be halted, and the Albuquerque Area Archaeologist notified.

L. Resource Related Pests

Possible solutions to the weed problem:

1. The Land Use Code must require that the land user make a conscientious effort to control weeds. A way must be achieved to enforce this provision.

2. Weed control around wells, pipeline, oilfield access routes and right-of-ways will be mandatory for gas and oil companies inside the Reservation boundary.

3. Provide education to land users in cultural and mechanical techniques that along with chemical, are part of a well rounded weed control program.

4. Improve cooperation with adjacent land users and weed control district where a joint weed problem exists.

5. Encouragement of land users to utilize the counties' chemical cost share program.

M. Other Values

The following stipulations will be employed to reduce visual impact:

1. To the maximum extent possible roads and facilities will be:

   a. Located away from populated areas, parks, scenic areas, hilltops, natural and man-made structures and prominent natural features such as distinctive rock or land forms, rivers, stream or arroyo crossings and other landmarks.

   b. Located to avoid crossing hills and ridges to avoid silhouetting unless

alternative location will result in greater disturbance.

c. Facilities should be located to use natural screens of vegetation or existing topographic features.

d. For sloping terrain, a multiple level, terraced facility plan should be considered to minimize excavation and provide a facility that would blend effectively. Near travel routes, facilities should be located part way up the slopes to provide a background of topography and/or natural cover when possible. Screen these facilities from highways and other areas of public view with natural vegetation and terrain.

e. Where placement of a facility is necessary in a hilltop area, consider locations on the slope or brow of a hill to allow minimum silhouette or skylining.

f. Facilities in general should be placed strategically to make maximum use of existing topography and vegetation for screening. Utilize the edge effect for facility placement along natural vegetation breaks.

g. Facilities should be located at the base of slopes when feasible to provide a background of topography and/or natural cover.

2. Within recreation areas all equipment with engines or motors will be equipped with quiet design mufflers (hospital grade or dual dissipative) or other noise abatement equipment or housed in acoustically insulated structures.

3. On roads with high potential for vehicle accidents, it is recommended that signs be placed warning public of heavy truck traffic.

4. Color (hue) of facilities is most effective within 1,000 feet (Johnson et. al., 1970). Beyond that point, the hue becomes indistinguishable and only the value of the color can be expected to have any appreciable effect. When viewed from the shaded side, a facility structure appears a dark silhouette and generally its color is indistinguishable. Consideration should be given to coloring facilities to blend with the landscape. This is particularly significant in or near areas of high scenic value.

V. CONSULTATION AND COORDINATION

A. Personnel

George R. Tetreault, Jr. Chief, Minerals Section Albuquerque Area Office	Ken Young Petroleum Engineer Albuquerque Area Office

alternative location will result in greater disturbance.

c. Facilities should be located to use natural screens of vegetation or existing topographic features.

d. For sloping terrain, a multiple level, terraced facility plan should be considered to minimize excavation and provide a facility that would blend effectively. Near travel routes, facilities should be located partway up the slopes to provide a background of topography and/or natural cover when possible. Screen these facilities from highways and other areas of public view with natural vegetation and/or berms.

e. Where placement of a facility is necessary in a hilltop area, consider locations on the slope or brow of a hill to allow minimum silhouette or skylining.

f. Facilities in general should be placed strategically to make maximum use of existing topography and vegetation for screening. Utilize the edge effect for facility placement along natural vegetation breaks.

g. Facilities should be located at the base of slopes when feasible to provide a background of topography and/or natural cover.

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V. CONSULTATION AND COORDINATION

A. Personnel

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APPENDIX F
VERTEBRATE SPECIES LISTS

APPENDIX F
VERTEBRATE SPECIES LISTS

TABLE F-1: List of reptile and amphibian species expected to occur in habitat types of the Study Area. This list is not considered to be all inclusive but rather a representation of the species that may be present.

Species Name	Grassland/ Shrubland	Gambel Oak	Coniferous Forest (Ponderosa Pine/ Piñon-Juniper)	Agricultural Land	Riparian (Shrubland and Forest)	Wetland (Marsh, Wet Meadow, and Pond)
Amphibians						
Tiger salamander *Ambystoma tigrinum*						X
Woodhouse's toad *Bufo woodhousii*				X	X	X
Striped chorus frog *Pseudacris triseriata*						X
Northern leopard frog *Rana pipiens*				X	X	X
Reptiles						
Short-horned lizard *Phrynosoma douglassii*	X	X				
Eastern fence lizard *Sceloporus undulatus*	X	X				
Collared lizard *Crotaphytus collaris*	X				X	
Sagebrush lizard *Sceloporus graciosus*	X				X	

Species Name	Grassland/ Shrubland	Gambel Oak	Coniferous Forest (Ponderosa Pine/ Piñon-Juniper)	Agricultural Land	Riparian (Shrubland and Forest)	Wetland (Marsh, Wet Meadow, and Pond)
Bullsnake *Pituophis melanoleucus*	X	X	X	X	X	X
Western terrestrial garter snake *Thamnophis elegans*				X	X	X
Western rattlesnake *Crotalus viridis*	X	X	X		X	X

TABLE F-2: List of bird species expected to occur in habitat types for the Study Area. This list is not considered to be all inclusive but rather a representation of some of the more common species present.

Species Name	Grassland/ Shrubland	Gamble Oak	Coniferous Forest (Ponderosa Pine/Piñon-Juniper)	Agricultural Land	Riparian (Shrubland and Forest)	Wetland (Marsh, Wet Meadow, and Pond)
Horned lark *Eremophila alpestris*	X			X		
Western meadowlark *Sturnella neglecta*	X			X		
Killdeer *Charadrius vociferus*	X			X		X
Western bluebird *Sialia mexicana*	X	X	X			
House finch *Carpodacus mexicanus*		X	X			

Species Name	Grassland/ Shrubland	Gamble Oak	Coniferous Forest (Ponderosa Pine/Piñon-Juniper)	Agricultural Land	Riparian (Shrubland and Forest)	Wetland (Marsh, Wet Meadow, and Pond)
American goldfinch *Carduelis tristis*	X				X	
Barn swallow *Hirundo rustica*	X				X	
Green-tailed towhee *Pipilo chlorurus*		X	X			
Mountain chickadee *Parus gambeli*		X	X			
American robin *Turdus migratorius*		X	X		X	
Mourning dove *Zenaida macroura*	X		X	X	X	
Williamson's sapsucker *Sphyrapicus thyroideus*			X			
Downy woodpecker *Picoides pubescens*			X		X	
Violet-green swallow *Tachycineta thalissina*		X	X			
Northern flicker *Colaptus auratus*		X	X		X	
Stellar's jay *Cyanocitta stelleri*			X			
Scrub jay *Aphelocoma coerulescens*		X				
Black-billed magpie *Pica pica*	X	X	X	X	X	

Species Name	Grassland/ Shrubland	Gamble Oak	Coniferous Forest (Ponderosa Pine/Piñon-Juniper)	Agricultural Land	Riparian (Shrubland and Forest)	Wetland (Marsh, Wet Meadow, and Pond)
Brewer's blackbird *Euphagus cyanocephalus*				X	X	
Common nighthawk *Chordeiles minor*	X	X	X	X	X	
Belted kingfisher *Ceryle alcyon*						X
Black-chinned humming bird *Archilochus alexandri*		X	X		X	
Dusky flycatcher *Empidonax oberholseri*		X	X		X	
Western kingbird *Tyrannus verticalis*			X		X	
Common raven *Corvus corax*		X	X		X	
Warbling vireo *Vireo gilvus*					X	
Yellow warbler *Dendroica petechia*					X	
Western tanager *Piranga ludoviciana*		X	X			
Black-headed grosbeak *Pheucticus melanocephalus*		X	X		X	
Lazuli bunting *Passerina amoena*	X	X				

Species Name	Grassland/ Shrubland	Gamble Oak	Coniferous Forest (Ponderosa Pine/Piñon-Juniper)	Agricultural Land	Riparian (Shrubland and Forest)	Wetland (Marsh, Wet Meadow, and Pond)
Red-winged blackbird *Agelaius phoeniceus*					X	X
Dark-eyed junco *Junco hyemalis*			X		X	
Chipping sparrow *Spizella passerina*			X			
Mallard *Anas platyrhynchos*						X
Wild turkey *Meleagris gallopavo*		X	X			
Turkey vulture *Cathartes aura*	X	X	X		X	
American kestrel *Falco sparverius*	X	X	X	X	X	
Swainson's hawk *Buteo swainsoni*	X				X	
Red-tailed hawk *Buteo jamaicensis*	X				X	
Golden eagle *Aquila chrysaetos*	X				X	
Bald eagle *Haliaeetus leucocephalus*	X				X	
Great horned owl *Bubo virginianus*			X		X	

TABLE F-3: List of mammal species expected to occur in habitat types of the Study Area. This list is not considered to be all inclusive but rather a representation of species present.

Species Name	Grassland/ Shrubland	Gambel Oak	Coniferous Forest (Ponderosa Pine/ Piñon-Juniper)	Agricultural Land	Wetland/Riparian (Forest, Marsh, Wet Meadow)
Desert cottontail *Sylvilagus audubonii*	X	X	X		
Mountain cottontail *Sylvilagus nuttallii*	X		X		
Black-tailed jackrabbit *Lepus californicus*	X	X			
Ground squirrels *Spermophilus spp.*	X	X	X		
Abert's squirrel *Sciurus aberti*			X		
Least Chipmunk *Tamias minimus*	X	X	X		
Pocket gophers *Thomomys* spp.	X	X		X	X
Mice *Peromyscus, Reithrodontomys* spp.	X	X	X	X	X
Voles *Microtus* spp.	X			X	X
Shrews *Sorex* spp.	X	X	X	X	X
Woodrats *Neotoma* spp.	X	X	X		
Porcupine *Erethizon dorsatum*			X		

Species Name	Grassland/ Shrubland	Gambel Oak	Coniferous Forest (Ponderosa Pine/ Piñon-Juniper)	Agricultural Land	Wetland/Riparian (Forest, Marsh, Wet Meadow)
Coyote *Canis latrans*	X	X	X	X	X
Red fox *Vulpes vulpes*		X	X	X	X
Grey Fox *Urocyon cinereoargenteus*				X	X
Raccoon *Procyon lotor*				X	X
Black bear *Ursus americanus*			X		
Long-tailed weasel *Mustela frenata*	X	X	X	X	
Badger *Taxidae taxus*	X	X			
Striped skunk *Mephitis mephitis*	X	X	X	X	X
Bobcat *Lynx rufus*		X	X		
Mountain lion *Felis concolor*			X		
Mule deer *Odocoileus hemionus*		X	X	X	X
American elk *Cervus elaphus*			X	X	X
Pronghorn *Antilocapra americana*	X				

Species Name	Grassland/ Shrubland	Gambel Oak	Coniferous Forest (Ponderosa Pine/ Piñon-Juniper)	Agricultural Land	Wetland/Riparian (Forest, Marsh, Wet Meadow)
Bats *Myotis* spp.			X	X	X

Table F-4: List of fish species known to occur in the rivers of the Study Area. Native species are marked with an *.

Species Name	La Plata River	Animas River	Pine River	Piedra River	San Juan River
Rainbow trout *Oncorhynchus mykiss*	X	X	X	X	X
Brown trout *Salmo trutta*	X	X	X	X	X
Colorado River cutthroat trout *Oncorhynchus clarki pleuriticus*	O				
Snake River cutthroat trout *Oncorhynchus clarki spp.*	O	X	X	X	X
Brook trout *Salvelinus fontinalis*	O	O	O	O	O
Kokanee salmon *Oncorhynchus nerka*			X	X	X
Bluehead sucker* *Catostomus discobolus*	X	X	X	X	X
Flannelmouth sucker* *Catostomus latipinnis*	X	X	X	X	X
White sucker *Catostomus commersoni*	O	X	X	X	X
Roundtail chub* *Gila robusta*	X	O	O		O

Species Name	La Plata River	Animas River	Pine River	Piedra River	San Juan River
Speckled dace* *Rhinichthys osculus*	X	X	X	X	X
Common carp *Cyprinus carpio*	O	X	X	X	X
Fathead minnow *Pimephales promelas*	X	X	X	X	X
Red shiner *Notropis lutrensis*	O	O			
Channel catfish* *Ictalurus punctatus*	O	O	X	X	X
Black bullhead* *Ameiurus melas*	O	O	X	O	O
Smallmouth bass *Micropterus dolomieui*			X		O
Largemouth bass *Micropterus salmoides*		O			O
Green sunfish *Lepomus cyanellus*	O	X	X	X	X
Bluegill *Lepomis macrochirus*			O		
Mottled sculpin* *Cottus bairdi*	X	X	X	X	X
Northern pike *Esox lucius*		O			O
Johnny darter *Etheostoma nigrum*		O			

X = Commonly found species   O = Has been documented or probably occurs in very limited numbers

APPENDIX G
BIOLOGICAL ASSESSMENT FOR OIL AND GAS DEVELOPMENT ON THE SOUTHERN UTE INDIAN RESERVATION, SUPPLEMENTAL BIOLOGICAL ASSESSMENT, AND CONCURRENCE LETTER FROM U.S. FISH AND WILDLIFE SERVICE

APPENDIX G

BIOLOGICAL ASSESSMENT
FOR OIL AND GAS DEVELOPMENT
ON THE SOUTHERN UTE INDIAN RESERVATION

United States Department of the Interior
Bureau of Land Management
Bureau of Indian Affairs

Southern Ute Indian Tribe

Prepared by:

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and
James T. Powers, Biological Scientist

San Juan Public Lands Center
August 27, 2001

INTRODUCTION

This document assesses the effects of implementing oil and gas development within the Southern Ute Indian Reservation as described in the Southern Ute Indian Tribal Oil and Gas Development Environmental Impact Statement. It is being written in accordance with Section 7 (C) of the Endangered Species Act (1973, as amended) and the Code of Federal Regulations 50 (Part 402).

A species list was received from the U.S. Fish and Wildlife Service on 6 May 1996 by the Bureau of Indian Affairs, Southern Ute Agency. This was reviewed and updated with Mr. Terry Ireland of the Grand Junction Fish and Wildlife Office in August, 2000. An updated list was received by the Public Land Center on 2 May 2001. On 25 July 2001, the yellow-billed cuckoo was listed as a candidate species because listing was warranted but precluded by higher priority listing actions (Federal Register 7/25/01).

The following species were considered for this analysis.

Endangered

Knowlton's cactus (*Pediocactus knowltonii*)
Mancos milkvetch (*Astragalus humillimus*)
Black-footed ferret (*Mustela nigripis*)
Whooping crane (*Grus americana*)
Southwestern willow flycatcher (*Empidonax traillii extimus*)
Colorado pikeminnow (*Ptychocheilus lucius*)
Razorback sucker (*Xyrauchen texanus*)

Threatened

Mesa Verde cactus (*Sclerocactus mesas-verdae*)
Bald eagle (*Haeliaeetus leucocephalus*)
Mexican spotted owl (*Strix occidentalis lucida*)
Canada lynx (*Lynx canadensis*)

Candidate

Gunnison sage grouse (*Centrocercus minimus*)
Western boreal toad (*Bufo boreas boreas*)
Yellow-billed cuckoo (*Coccyzus americanus occidentalis*)

This BA accompanies the programmatic Environmental Impact Statement (EIS) for the Southern Ute Indian Tribe Oil and Gas Development Project. Because of the programmatic nature of the EIS, site-specific locations for project facilities have not been selected. Instead, development windows (20-acre parcels) have been identified to designate where well pads and other facilities are likely to be constructed. The analysis of impacts on many resources is based on the number of development windows which would be developed under each alternative and the percentage of habitat that could potentially be impacted relative to the available habitat within the Assessment Area.

The U.S. Fish and Wildlife Service (USFWS) has requested preparation of a BA because of the potential for impacts to occur on TES species as a result of the construction, production and abandonment activities which are part of the Agency and Tribal Preferred Alternative (Ireland 1997).

Although this is a programmatic EIS, formal consultation with the USFWS is requested. Individual gas development projects that follow this EIS and that have the potential to affect any TES species will require a site-specific BA and may also need to complete formal consultation with the USFWS prior to site specific approvals (Ireland 1997).

A sequential series of tasks were conducted to prepare this assessment as follows:

1. Prefield Review: All TES species that have the potential to occur in the Assessment Area, were identified by the USFWS in letters dated 6 May 1996, August 2000, and 2 May 2001 and were reviewed in this task. Habitat requirements, seasonal-use patterns, and ranges or distributions are discussed in this section. This USFWS letter is referenced in Section 8.0 of this BA.

2. Field Reconnaissance: Based on the results of the prefield review, a field reconnaissance was conducted to assess the Assessment Area for habitat suitability.

3. Analysis of Effects: Based on the information obtained and provided in this assessment, an analysis of how proposed development could impact TES species, including the effectiveness of mitigation measures, was conducted. This section also provides a general description of those project effects that could be considered to be significant impacts.

4. Determination of Impacts: Based on the analysis of effects, a determination was made on the impacts proposed development would have on TES species.

5. Documentation: A documentation record is provided that includes references that were used and contacts that were made to prepare the BA.

CONSULTATION TO DATE

A biological assessment was completed by consultants in the fall 2000 and was submitted to the U.S. Fish and Wildlife Service (FWS) in October by the Bureau of Land Management (BLM). The BLM received a letter from the FWS on 1 November 2000 stating they would be unable to complete consultation "due to insufficient and conflicting information within the BA and cover letter."

A meeting was convened on 5 and 6 February 2001 to review the project. Participants included the Bureau of Land Management, the Southern Ute Indian Tribe, and the U.S. Fish and Wildlife Service. Issues identified in the 1 November letter were discussed. A presentation was given by Matt Janowiak (BLM) regarding water depletions associated with the project. A draft biological assessment was submitted via electronic mail to the U.S. Fish and Wildlife Service on 6 July 2001 and was reviewed by Bob Leachman of the Grand Junction Office. His comments along with comments provided by the Bureau of Indian Affairs and the Durango Public Lands Center have been incorporated into this document.

CURRENT MANAGEMENT DIRECTION

Current management direction for oil and gas leasing and development is found in the following documents: Colorado Oil and Gas Leasing and Development Final Environmental Impact Statement (1991), Environmental Assessment of Oil and Gas Leasing and Development on Southern Ute Indian Reservation (1990), the Intra-Service Section 7 Consultation for Minor Depletions of 100 Acre-feet or Less From the San Juan River Basin, and the San Juan and San Miguel Resource Management Plan (1994). These documents set out a general framework for oil and gas development and provide general management direction for protection of threatened and endangered species. In practice, biological assessments are completed for individual projects under the auspices of these past programmatic framework documents.

DESCRIPTION OF ASSESSMENT AREA

The Assessment Area covers the western and central regions of the Southern Ute Indian Reservation and includes approximately 421,200 acres in LaPlata County, Colorado. The Tribe does not allow development in the eastern portion of the Reservation, as described in the Tribe's *Natural Resources Management Plan, 1990-2010* (Southern Ute Indian Tribe 1990). Although the Reservation is a patchwork of Indian and non-Indian land, the EIS addresses the potential development only upon jurisdictional lands (Tribal and allotted mineral ownership) within the Assessment Area. The project area for the EIS is thus the jurisdictional lands within the Assessment Area, as depicted on EIS Map 4 which is included in this BA.

The south-central portion of the Assessment Area has historically proven to have the most productive conventional gas reservoirs. To evaluate the impacts from the potential conventional wells, the assumption was made that the conventional wells, which would include exploration wells and new development wells, would be drilled throughout the Assessment Area rather than in small discreet pockets. This probably overestimates the extent of impact.

The coalbed methane CBM wells that would be drilled under the Proposed Action were assumed to be restricted to the area of the occurrence of the Fruitland Formation. This can be defined as within the hogback of the San Juan Basin (see Map 4 in this BA). CBM well development is not assessed to the west of the Hogback in the Assessment Area.

DESCRIPTION OF THE PROPOSED ACTION

The Southern Ute Indian Tribe (SUIT) proposes to increase exploration and development of the mineral resources on its reservation in southwestern Colorado. The Bureau of Indian Affairs (BIA) and Bureau of Land Management (BLM), as agents for the Secretary of Interior, have the responsibility for administering the leasing and development of the oil and gas resource where the mineral estate is held in trust for the Indian people. The SUIT, through the auspices of the Indian Self Determination Act, is taking an increasingly active role in the management of their mineral resources.

The EIS analyzes the impacts of oil and gas exploration and development and the resultant potential impacts of the construction of access roads and drill pads; drilling operations; and construction, operation, and maintenance of production and transportation facilities within the exterior boundaries of the Reservation. The EIS is a programmatic analysis of three alternatives under consideration and is not an analysis of a specific project. Additional NEPA documentation will be completed for individual well proposals and tiered to the EIS when APD's are filed.

The Agency and Tribal Preferred Alternative, or Proposed Action, is the reasonably foreseeable oil and gas development which might occur if both infill of coalbed methane (CBM) spacing units and enhanced coalbed methane (ECBM) recovery methods were utilized in the EIS Assessment Area. Status quo development of conventional wells and of previously undrilled CBM spacing units would also occur under the Preferred Alternative.

The Agency and Tribal Preferred Alternative allows for the optional development of one additional CBM well, or infill well, on a majority of CBM spacing units within the Assessment Area. Conventional gas well development would continue under the current spacing rules. Additionally, the Preferred Alternative may include the use of ECBM recovery methods, such as nitrogen and carbon dioxide injection, in specific areas which have not yet been identified. Injection wells that are drilled for ECBM recovery projects are not counted as infill wells in assessing the development of a unit under the applicable spacing rule. Over the twenty-year life of the project, the reasonably foreseeable development under the Preferred Alternative includes 706 new wells on Tribal mineral estate within the Assessment Area (269 conventional gas wells, 367 CBM wells, and 70 injection wells).

Development of infill wells will be mostly in the "main" area of the Ignacio Blanco Field. Gas production rates and cumulative recoveries from CBM wells vary significantly within Assessment Area. Operators have informally designated the "fairway," an area within the Assessment Area where well production is high and permeability of the coal is believed to be high. The area within 1.5 miles of the Fruitland outcrop in the Assessment Area has been designated in this EIS as the buffer zone. Any portion of the CBM development area that is not within the fairway or the buffer zone is considered part of the main area. For numerous technical reasons related to production potential, it is believed that the main area would contain the vast majority of the infill drilling and ECBM project development. It is important to note that infill is not expected to be desirable or feasible in every CBM unit.

The impacts of future CBM development on resources were assessed based on the idea of development windows. A development window is a 20-acre area within a 160 acre CBM spacing unit in which a CBM well could be drilled in the future. All the resources contained in each 20 acre development window were considered to be potentially impacted by development of that window. A well pad disturbs only approximately 3 acres of surface, but in this programmatic EIS we do not know the exact location of the CBM well within the 20 acre well window and thus where the 3 acre disturbance would occur within the window. For this reason, any resource present in a window was considered disturbed by development, even though in actuality only 3 acres would be impacted. This

method tends to overestimate the impacts which were assessed.

Construction Phase

The construction phase of the proposed action includes the installation of drill pads, roads, and pipelines, the drilling and completion of wells, and the installation of production equipment, including compressors. Anticipated impacts from the construction phase for the Preferred Alternative include surface disturbances, water use, noise, and traffic. Standard operating procedures, and mitigation measures, including best management practices which are discussed below, would reduce potential impacts from construction operations.

Surface disturbance is necessary to construct drill pads, pipeline, roads, and other facilities. Each new well pad requires initially disturbing approximately 3 acres. Each new well co-located on an existing well pad requires expanding the existing pad by approximately 1 acre. Construction of 706 wells on Tribal mineral estate lands would result in the surface disturbance of approximately 2,160 acres if all new well pads were constructed. Surface disturbance in the rights of way, such as for pipelines, is reclaimed immediately after construction. Most other facilities, such as compressors, are expected to be co-located with wells or with existing facilities in order to minimize construction impacts and costs.

Well construction is projected to require approximately 29 acre-feet of fresh water per year for well drilling, cementing, fracture stimulation and associated activities. Produced (non-fresh, non-tributary formation) water can be used, and even reused, in most other well construction operations, such as for drilling mud. The fresh water would be obtained primarily from irrigation allocations. In addition, operating coalbed methane wells in the Indian Creek area will continue to intercept and produce 37 acre-feet per year of groundwater that would normally discharge to the Animas River or Basin Creek. This produced water will be pumped into deep formations or evaporation ponds, effectively removing the water from the river recharge system. Therefore, a total of 66 acre-feet per year would be depleted from the San Juan River system as a result of the proposed action. (29 a.f. of irrigation water + 37 a.f. of intercepted recharge = 66 a.f.) Please see Appendix A for a water depletion summary (Janowiak 2001).

Construction operations create noise and additional traffic, including some heavy truck traffic. However, these potential impacts are limited to the construction period, which is relatively brief (generally 1-2 months) for each location and to the immediate vicinity of the construction project. The construction period would be planned so that it does not interfere with critical life history phases (i.e. nesting, breeding) of TES species known to exist in the project area. For these reasons, these potential impacts were not considered significant.

Production Phase

In general, no direct impacts from surface disturbances are expected to occur on TES and their habitats during the production phase of the Agency and Tribal Preferred Alternative. Areas of

surface disturbances from the construction phase are expected to be reduced through reclamation and revegetation in the production phase. The area of remaining surface disturbances would include 1,454 acres of Tribal mineral estate lands. In general, the area disturbed around each new well pad (3 acres) would be reduced to 2 acres in the production phase. Surface disturbances in the rights-of-way are reclaimed immediately after construction and therefore would remain undisturbed in the production phase.

Surface disturbances of vegetation types that would re-vegetate slowly (i.e., 50-100 years), such as ponderosa pine forest or woodland and piñon-juniper woodland, would be initially replaced by grasses and shrubs and would not be expected to return to the pre-disturbance habitat type during the production phase. Therefore, many of the vegetation types that support TES, such as wooded riparian vegetation and coniferous forests, if developed, are not anticipated to be replaced during oil and gas production. Riparian vegetation grows relatively quickly, although decades would be required to grow mature trees. Disturbances to wildlife resulting from the operation of machinery and vehicles (e.g., noise) are expected to occur throughout the 20-year life of this project.

Abandonment Phase

The abandonment phase would involve the reclamation and revegetation of well pads, rights-of-way, and other facilities which were not previously reclaimed in addition to the actual plugging of the wells. All equipment will be removed from the locations and the well casing will be cut off. The area of surface disturbances in the abandonment phase would decrease from the disturbance area of the production phase as reclamation proceeds. Surface disturbances of habitats such as grasslands/shrublands would revegetate relatively quickly (i.e., several growing seasons). Surface disturbances of vegetation types which grow slower, such as ponderosa pine and piñon-juniper, would be first replaced by grasses and shrubs and would not establish characteristics of woodland communities for approximately 35 to 50 years. Losses of mature forest would be long term and forest characteristics are not expected to develop for 50 to 100 years following the completion of production. Riparian vegetation grows relatively quickly, although decades would be required for the growth of mature trees.

In general, no new impacts are expected to occur on TES during the abandonment phase of the proposed project, provided that best management practices are followed to avoid contamination (e.g., sedimentation from erosion) of local streams and rivers and that abandonment activities (e.g., noise) do not disturb sensitive areas (e.g., active nest sites).

PRE-FIELD REVIEW

The Federally listed TES wildlife, fish, or plant species that have the potential to occur in the SUIT EIS Assessment Area are listed in Table 1.

The Mesa Verde cactus, black-footed ferret, Canada lynx, Gunnison sage grouse, whooping crane, yellow-billed cuckoo, and western boreal toad will not be considered further in this analysis since they are known not to occur, or are unlikely to occur in the Assessment Area. A further consideration for the black-footed ferret, was the lack of large prairie dog colonies within the

Assessment Area. The colonies are more typically small, fragmented, and scattered. The razorback sucker and Colorado pikeminnow will continue to be analyzed since water depletions affect downstream habitats where these fish are known to exist.

Table 1. Summary of Federally listed species that may occur within the Southern Ute EIS Assessment Area.

Species	Habitat	Presence
Knowlton's cactus	Pinyon juniper on tertiary alluvial deposits	Present
Mancos milkvetch	Mesa Verde Group outcrops	Possible
Mesa Verde cactus	Salt desert scrub communities in Fruitland and Mancos shale formations	Unlikely
Black-footed ferret	shortgrass to midgrass prairie to semidesert shrublands	Very unlikely
Whooping crane	mudflats around reservoirs and in agricultural areas	Migrant, possible but unlikely
Bald eagle	reservoirs and rivers	Present
Southwestern willow flycatcher	foothill and montane riparian thickets	Likely
Mexican spotted owl	steep canyons and dense forest	Possible
Yellow-billed cuckoo	wooded riparian of cottonwood and willow	Very unlikely
Canada lynx	high elevation spruce/fir forests	Not present
Gunnison sage grouse	sagebrush shrublands	Very unlikely
Western boreal toad	subalpine riparian areas	Not present
Razorback sucker	rivers	Not present
Colorado pikeminnow	rivers	Not present

Based on information from USFWS and CDOW sources, it was determined that a number of TES wildlife species and/or their habitat had the potential to occur in the Assessment Area. A field reconnaissance was conducted to inspect the habitat types present within the Assessment Area. Due to the programmatic nature of this EIS, site-specific field surveys were not conducted for certain species. These surveys would be conducted during the Preconstruction Phase when a site-specific Application for Permit to Drill (APD) or Application for Right-of-Way is filed.

STANDARD OPERATING PROCEDURES

The following measures are standard operating procedures during gas and oil development and are

part of the proposed action.

- Where feasible, minimize surface disturbances by using existing well pads or minimizing well pad size.
- Access new wells using existing roadways or short spurs rather than through construction of new primary roads.
- Utilize existing rights-of-way for roads and pipelines to the greatest extent possible, to avoid fragmentation of Federally listed and rare plant and wildlife habitat.
- Reclaim and re-vegetate all areas of disturbed soil and include approved seed mixes, fertilizer, and mulch. Use native plants of the Reservation for reclamation. Monitor re-vegetated areas and conduct treatment repetitions, as necessary.
- Require noxious weed control in conjunction with all new oil and gas facilities and roads.
- Manage herbicide use under the supervision of a licensed pesticide applicator, and application, storage, and disposal procedures should meet state and Federal requirements.
- Separate topsoil and set aside for reclamation purposes.
- Prevent wildland fires whenever and wherever possible. Prevention methods include the use of spark arresters on chainsaws and mufflers on vehicles, as well as restrictions on burning.
- Avoid wetlands. If avoidance is impossible, identify unavoidable direct and indirect impacts on wetland areas during the individual well development planning stages. Develop wetland mitigation/monitoring plan and obtain necessary 404 permitting prior to initiation of construction activities.
- Avoid impacts to riparian and wetland systems to the extent possible. Minimize the number of stream crossings by roadways and pipelines. Cross streams and riparian areas at right angles, rather than parallel, by rights-of-way, including roads and pipelines, in order to minimize the area of impact on this resource.
- Protect water quality within, and downstream of, the project area from soil erosion and sedimentation by Best Management Practices, as described in the Application for Permit to Drill, that include erosion control devices and management procedures.
- Develop and implement spill prevention procedures.
- Avoid removal of mature, over-story riparian vegetation wherever possible.
- Line waste water pits to prevent contamination to ground water.

MITIGATION MEASURES

The following additional measures were developed to mitigate impacts to threatened and endangered wildlife and plant species within the project area. They are part of the proposed action.

- Conduct field surveys for Knowlton's cactus prior to all construction activities.
- Avoid individuals and populations of Knowlton's cactus which may be impacted by activities.
- Conduct surveys for Mancos milkvetch and avoid prior to well pad and rights-of-way construction activities.
- Minimize construction activities in wooded riparian habitat.
- Do not remove large cottonwood trees or other large trees within bald eagle winter range or winter concentration areas.

- Conduct annual winter roost surveys for bald eagles. Restrict well locations and rights of way to a distance of at least 0.25 miles away from active winter roosts.
- Restrict activities from 15 November to 15 March in bald eagle winter range and winter concentration areas.
- Construct well pads and rights of way at least 0.25 miles from active bald eagle nests.
- Restrict activities that could disturb nesting bald eagles within 0.5 miles of active bald eagle nests from January 1 to July 1.
- Avoid removal of large cottonwood or other large trees within the areas designated as bald eagle winter range or winter concentration areas, and areas that may provide nesting habitat.
- If development activities are required within bald eagle winter range or concentration areas, they would be restricted to working from 10:00 am to 2:00 pm (Craig 1995).
- If Mexican spotted owls are located within the Assessment Area, delineate Protected Activity Centers (PAC) around the nest or roost site by SUIT biologists and the FWS.
- Restrict development activities within a PAC, although they would be evaluated on a project-specific basis (USFWS 1995).
- Conduct Southwestern willow flycatcher surveys within suitable habitat prior to any construction activities to determine presence or absence of willow flycatchers.
- If Southwestern willow flycatchers are located during survey efforts, no surface disturbing activities would be conducted from late May through mid-July.
- Use Best Management Practices to avoid contamination of local streams and rivers to protect the razorback sucker and Colorado pikeminnow.

ANALYSIS OF EFFECTS

This section analyzes the TES that are known to occur in the Assessment Area or, based on available habitats, have the potential to occur in the Assessment Area. Information on species name, status, distribution/habitat, and also a conclusion regarding the likelihood of occurrence within the Assessment Area are provided. Also included in this section is an analysis of direct, indirect and cumulative effects that proposed gas development may have upon these species and/or their habitats. This section contains specific construction and operation practices that would help avoid or mitigate impacts on these species.

Species: **Bald eagle** ***(Haliaeetus leucocephalus)***

Status: Federally Threatened

Distribution/Habitat: Bald eagles occur in Colorado primarily in the winter and are typically present from October to March. Bald eagles are considered to be uncommon to locally uncommon winter residents of the western valleys of Colorado. Wintering areas may include semideserts and grasslands, especially near prairie dog towns (Andrews and Righter 1992). Winter roost sites generally occur in sheltered areas with large trees for perching, a nearby food source, and minimal human disturbance. Bald eagles feed primarily on fish, prairie dogs, rabbits, and waterfowl. Bald eagles are considered to be a rare summer resident in restricted localities of Colorado. Although some nesting occurs in Colorado, most bald eagles migrate to northern breeding grounds and return to lower latitudes in winter. Populations have been severely impacted by shooting, habitat

destruction, and pesticides.

Potential to Occur in Assessment Area: Bald eagles are known to both nest and winter in various locations throughout the Assessment Area. Winter range, including habitat designated as winter concentration areas by the CDOW, occurs along all the major drainages in the Assessment Area, as well as between the Florida and Pine rivers along northern boundary of the Reservation (see EIS Map 9 which is included in this BA). As many as 10 bald eagles may be present along the Pine River in winter (Diswood 1996). Three known active bald eagle nests occur within the Assessment Area, one is located near the Town of Allison west of the Navajo Reservoir and two are located on the Pine River north and south of the Town of Ignacio, respectively. All nests have been documented in large, mature cottonwood trees (Stroh 1998). Historic bald eagle nest sites also occur along the Animas and Pine rivers within the Assessment Area; these sites may be used by bald eagles again in the future.

Analysis of Effects: Bald eagles could be impacted both by the removal of wooded riparian vegetation as well as disturbances caused by gas development. Removal of wooded riparian vegetation primarily would occur during the construction phase (e.g., roads, drill pads, pipelines, and other facilities), rather than the operation and abandonment phases. While the removal of riparian vegetation would be minimized through avoidance as described above, nevertheless some minor fragmentation and degradation of this habitat type could occur.

Based on estimates of likely locations of wells, rights-of-way, and other facilities, direct impacts from surface disturbances to TES habitats were calculated. A maximum of 422 acres of bald eagle winter habitat would be directly impacted by construction of the Agency and Tribal Preferred Alternative without mitigation. These values represent 0.72 percent of the resource in the Assessment Area. By constructing on existing well pads, the area of disturbance can be reduced to 346 acres (0.59 percent). Furthermore, as prescribed as a first line of mitigation, this impact would be further reduced by siting well pads such that sensitive areas are avoided as much as possible.

Within the bald eagle winter concentration areas, a maximum of 77 acres would be directly impacted by the Agency and Tribal Preferred Alternative. These values represent 0.48 percent of the resource. By constructing on existing well pads, the area of disturbance can be reduced to 67 acres (0.42 percent). However, by following the prescribed mitigation it is possible to greatly reduce this direct impact by siting well pads such that sensitive areas are avoided as much as possible.

Disturbance-related impacts could be expected to occur throughout the year, especially during the production phase. Disturbance-related impacts from construction are expected to be short-term, although more severe than the operation phase. During winter months (November 15 through March 15), project activities within or directly adjacent to bald eagle winter ranges and winter concentration areas could result in the abandonment of some of these areas and may force individuals to use less optimal habitats. However, to reduce such impacts, construction would be restricted from 15 November to 15 March in bald eagle winter range and concentration areas.

Three active bald eagle nests are known to occur within the Assessment Area. Disturbance-related impacts that occur during summer months within or directly adjacent to bald eagle nesting sites

could cause the disruption or abandonment of nesting activities. No activity would occur within 0.25 mile of an active nest. Seasonal restrictions during the eagle's reproductive period would be imposed within a 0.5 mile area to protect nesting birds.

Oil and gas activities could impact the eagle's prey base, including both fisheries and small mammal populations. Degradation of the water quality and quantity of local streams and rivers, and subsequently the degradation of fisheries, could adversely impact both summer and winter residents. Potential impacts on water quality could occur as a result of erosion and sedimentation, as well as from contamination from accidental spills and leaks associated with machinery fuels, lubricants, and drilling fluids. However, erosion and sedimentation would be minimized as described above by implementing best management practices, required spill prevention and remediation procedures, and containing fluids typically in small, lined and bermed areas or pits. Production water, which is highly saline, will be reinjected into formations below the Fruitland Formation and should not affect water quality or quantity, unless accidental spills occur.

Cumulative Effects: Based on the estimates of surface disturbances from existing oil and gas development within the Assessment Area, the cumulative effect of the Agency and Tribal Preferred Alternative combined with existing well pad development could maximally result in a total surface disturbance of 2,989 acres (5.1 percent of the resource) of bald eagle winter range and 719 acres (4.5 percent of the resource) of bald eagle winter concentration areas. Again, these impacts would be reduced by utilizing existing well pads where feasible and practical and by avoiding wooded riparian areas. Other cumulative effects, though difficult to quantify, could result from residential and other forms of development within wooded riparian habitats within the Assessment Area as well as from additional oil and gas and other development outside the Assessment Area.

We project that an additional 375 CBM wells will be constructed in the northern San Juan Basin, north of the Southern Ute EIS Assessment Area. This additional development is currently under study by the US Forest Service and BLM. Development of a lesser number of wells (95 wells) in the northern Basin was studied in the 1992 Forest Service/ BLM HD Mountain Gas Development EIS. The HD's EIS Assessment Area included bald eagle winter range along the Piedra and Pine rivers. The 1992 Biological Assessment for the HD's EIS concluded that 62 acres of eagle winter range would be impacted. The BA further concluded that there would be no-effect on the bald eagle. Mitigation measures approved in the HD's EIS Record of Decision are similar to those presented in this BA. The greater level of development now projected in the northern San Juan Basin has the potential to increase the density of wells in bald eagle winter range and thus to affect the species in ways similar to that described in this BA. Total avoidance of eagle winter range would not be possible if development were to proceed according to gas industry plans. The northern Basin CBM development EIS is still in scoping.

Mitigation Measures:

- Conduct surveys of nesting and roosting areas during appropriate seasons each year prior to initiation of site-specific project activities to determine if nest or roosting sites are active.
- Construct well pads and ROW's at least 0.25 miles from active bald eagle nests and active winter roosts.

- Restrict activities that could disturb nesting bald eagles within 0.5 miles of active bald eagle nests from January 1 to July 1.
- Avoid removal of large cottonwood or other large trees within the areas designated as winter range or winter concentration areas, and areas that may provide nesting habitat.
- Restrict activities within winter range or winter concentration areas during the period from November 15 to March 15.
- If development activities are required within bald eagle winter range or winter concentration areas, they would be restricted to the hours of 10:00 a.m. to 2:00 p.m. (Craig 1995).

Conclusions and Determination:

- There are nest and roost sites within or adjacent to the Assessment Area.
- Individuals are regularly sighted within or adjacent to the Assessment Area
- There is designated winter range and concentration activities within the Assessment Area.
- There are currently suitable nest or roost trees.
- Mitigations have been designed to protect active nest sites.
- Winter range and concentration activities may be affected by oil and gas construction and production activities, either by direct disturbance of nest and roost sites, or by impacting eagle prey base. Total avoidance of winter range and concentration areas is not possible.
- Standard operating procedures, and the mitigation outlined in this assessment should reduce potential impacts. Site specific project design would also incorporate project specific biological assessments and their recommendations, further reducing impacts during actual project development.

It is my professional determination that the oil and gas development on the Southern Ute Indian Reservation <u>may affect and is not likely to adversely affect</u> the bald eagle.

<u>Species</u>: **Southwestern willow flycatcher** (*Empidonax traillii extimus*)

<u>Status</u>: Federally Endangered

Distribution/Habitat: The FWS listed the southwestern willow flycatcher as endangered in February 1995. The southwestern willow flycatcher is a subspecies of one of the ten North American flycatchers in the genus Empidonax. Willow flycatchers are Neotropical migrants. The southwestern willow flycatcher arrives on breeding grounds as early as mid-May and may be present through mid-August. Migration routes and winter ranges are not well known.

The southwestern willow flycatcher breeds in riparian habitats along rivers, streams or other wetlands, where dense growths of willows (*Salix* spp.), seepwillow (*Baccharis* spp.), arrowweed (*Pulchea* spp.), buttonbrush (*Cephalanthus* spp.), or other shrubs and medium-sized trees are present, often with a scattered overstory of cottonwood (*Populus* spp.) (Tibbitts et al. 1994). Thickets or shrubs are approximately 13-23 feet in height, with dense foliage from approximately 13 feet above ground, and often a high canopy cover percentage. Nest site vegetation may be even or uneven-aged, but is usually dense and structurally homogenous (USDI 1995a). Surface water or

saturated soil is virtually always present in or adjacent to nesting thickets. The nest-site community may be even-aged, or consist of diverse age classes of various plant taxa. Stream gradient may be also an important determinant in habitat suitability.

The distribution of the southwestern willow flycatchers within the state of Colorado includes areas below 8,500 feet elevation within the southwestern corner of the state extending north to Rifle, Garfield County, and east to Fort Garland, Costilla County (USFWS 1996).

Potential to Occur in Assessment Area: No comprehensive surveys have been done for the southwestern willow flycatcher within the Assessment Area, although surveys have been completed in support of individual well projects. Suitable habitat has been identified and has been mapped for the EIS. The ability to identify suitable nesting habitat for the willow flycatcher was difficult with the available vegetation data. Wooded riparian habitat has been used as a proxy and likely significantly over-represents what is actually available for nesting habitat (see EIS Map 6 which is included in this BA). Additionally, large willow stands associated with irrigation canals may provide additional suitable nesting habitat.

It is considered possible that the southwestern willow flycatcher breeds in the Assessment Area, although none have been identified. In 1995, willow flycatchers were identified near Pastorius Reservoir, which is located in the north-central region of the Assessment Area; however, these individuals were considered migratory and were not observed in the Assessment Area during the breeding season (T. Ireland, USFWS, personal communication, 1997). Other individuals have been located near Bayfield and south of the Assessment Area in New Mexico (Chris Schultz, pers. comm. 2001).

Analysis of Effects: Although suitable breeding southwestern willow flycatcher habitat does exist in the Assessment Area, no southwestern willow flycatchers have been identified and no critical habitat has been designated in the Assessment Area. Areas of suitable habitat would be surveyed in the future and a site specific BA conducted prior to the initiation of any site-specific oil and gas development projects.

The majority of the potential direct impacts on the southwestern willow flycatcher would occur from the removal of vegetation that would result from the construction phase (e.g., roads, drill pads, pipelines, and other facilities), rather than during the production and abandonment phases. Breaking up the riparian habitat would cause fragmentation and degradation of possible nesting habitat. Within the southwestern willow flycatcher's possible habitat (wooded riparian habitat), a maximum of 171 acres would be potentially impacted. This values represent 2.10 percent of the resource. By constructing on existing well pads, the area of maximum disturbance can be reduced to 165 acres (2.02 percent). However, it is the intent to greatly reduce this potential direct impact by siting well pads during project design such that sensitive areas are avoided as much as possible. The impacts to riparian vegetation would be minimized during site specific project design.

Cumulative Effects: Based on the estimates of surface disturbances from existing oil and gas development within the Assessment Area, the cumulative effect of the Agency and Tribal Preferred Alternative combined with the existing well pad development would result in potential total surface

disturbance of 484 acres (5.9 percent of the resource) of wooded riparian habitat. However, this potential impact would be minimized by siting wells and roads away from flycatcher habitat during individual project design. In addition, this may be an overestimate of total acres disturbed since wooded riparian vegetation was used as a proxy for nesting habitat. Other cumulative effects, though difficult to quantify, could result from residential and other forms of development within riparian habitats within the Assessment Area, as well as from additional oil and gas and other development outside the Assessment Area.

In the northern San Juan Basin, there are similar habitat patterns as described for the Southern Ute Assessment Area. Suitable riparian areas are scattered throughout the analysis area. Suitable habitat will be mapped for the northern Basin EIS and similar mitigation as described here, including avoidance and timing limitations on activities, would apply.

Mitigation Measures:

- Conduct surveys within suitable habitat prior to any construction activities to determine presence of willow flycatchers.
- If birds are located during survey efforts, no surface disturbing activities would be conducted from 1 May through 15 August.
- Minimize disturbance to nesting habitat for the southwestern willow flycatcher.

Conclusions and Determination:

- No comprehensive surveys have been conducted for the Assessment Area. No nesting flycatchers have been observed in the Assessment Area during site specific surveys for individual well projects.
- Site specific surveys and BA's would be conducted prior to ground disturbing activities.
- A seasonal closure would be implemented to protect birds located during the survey effort.
- Riparian areas and wetlands would be avoided to the extent possible during project design. However, individuals or their nests could possibly go undetected during surveys potentially being impacted by well construction activities.

It is my professional determination that the oil and gas development on the Southern Ute Indian Reservation <u>may affect and may adversely affect</u> the Southwestern willow flycatcher.

<u>Species:</u> **Mexican spotted owl (*Strix occidentalis lucida*)**

<u>Status</u>: Federally Threatened

Distribution/Habitat: The FWS listed the Mexican spotted owl as threatened in April 1993. This spotted owl is geographically isolated from the Northern and California subspecies. It is distributed discontinuously throughout its range, with its distribution largely restricted to montane forests and canyons. It occurs in disjunct localities that correspond to isolated mountain systems and canyons.

Mixed conifer forests are commonly used throughout most of the owl's range. These forests are dominated by Douglas-fir and/or white fir, with codominant species including southwestern white pine, limber pine and ponderosa pine. The understory often contains these species as well as broad-leaved species such as Gambel oak, maples, boxelder and New Mexico locust (USDI 1995b). Mexican spotted owls typically nest and roost in closed-canopy forests or deep shady canyons; both situations provide cool micro-sites. They breed sporadically and do not nest every year. Eggs are laid in late March or, more typically, early April. The eggs usually hatch in early May (USDI 1995b).

Spotted owls appear to occupy two disparate canyon habitat types. The first is sheer, slick-rock canyons containing widely scattered patches (up to 1 ha in size) of mature Douglas-fir in or near canyon bottoms or high on the canyon walls in short, hanging canyons. The second consists of steep canyons containing exposed bedrock cliffs either close to the canyon floor or, more typically, several tiers of exposed rock at various heights on the canyon walls. Mature Douglas-fir, white fir, and ponderosa pine dominate canyon bottoms and both north- and east-facing slopes. Ponderosa pine grows on the more xeric south- and west-facing slopes, with pinyon-juniper growing on the mesa tops.

The owls nest and roost primarily in closed-canopy forests or rocky canyons. Forests used for roosting and nesting often contain mature or old-growth stands with complex structure. These forests are typically uneven-aged, multi-storied, and have a high canopy closure. Nest trees are typically large in size, where as the owls typically roost in both large and small trees. Douglas-fir is the most common species of nest tree.

In general, owls forage more in unlogged forests than in selectively logged forests. Both high-use roosting and high-use foraging sites had more big logs, higher canopy closure, and greater densities and basal areas of both trees and snags than random sites. Owls use a wider variety of forest conditions for foraging than they used for roosting (USDI 1995b).

Potential to Occur in Assessment Area: Spotted owl surveys were conducted in areas of suitable habitat within the Assessment Area. These surveys occurred prior to development of the EIS. No spotted owls were located. The Assessment Area is dominated by pinyon-juniper which is not suitable for nesting (T. Stroh, SUIT, personal communication 1997).

Analysis of Effects: No Mexican spotted owls are presently known to occur within the Assessment Area. If this owl is identified within the Assessment Area, management sites known as Protected Activity Centers (PACs) would be delineated by the SUIT biologists and USFWS around the nest site or roost site and typically would include an area of no less than 600 acres (USFWS 1994). Development activities generally would be restricted within a PAC, although they would be evaluated on a project-specific basis (USFWS 1995).

The removal of forest vegetation for construction would have a direct effect on spotted owl habitat. Clearing for rights-of-way would degrade habitat through fragmentation and create more edge. No suitable nesting habitat for the Mexican spotted owl would be affected under the Preferred Alternative since no nesting habitat is located within the Assessment Area. There is approximately

1,021 acres (6%) of suitable foraging habitat which would be affected by the surface disturbance.

Cumulative Effects: Based on the estimates of surface disturbances from existing oil and gas development within the Assessment Area, the cumulative effect of the Agency and Tribal Preferred Alternative combined with the existing well pad development is anticipated to result in a total surface disturbance of 1,021 acres (6 percent of the resource) of ponderosa pine vegetation, which is considered to be foraging habitat for the Mexican spotted owl. No nesting habitat is present within the Assessment Area, although it may be present in areas of densely, wooded coniferous forest in the vicinity of the Assessment Area. Foraging habitat has been identified within the Assessment Area. Other cumulative effects, though difficult to quantify, could result from timber harvest of coniferous forests within ponderosa forests in the Assessment Area as well as from additional oil and gas and other development outside the Reservation.

In the northern San Juan Basin EIS Assessment Area, areas of foraging habitat are present in the HD Mountains. Mexican spotted owl surveys were completed in the HD mountain area in the Ignacio Creek, Bull Creek, Turkey Creek, and Fosset Gulch drainages in 1990, 1991, 1996 and 1998. An owl was heard calling in the Fosset Gulch drainage in 1996 but no activity center was located, nor was the owl located again (Chris Schultz pers. comm 2001). No other owls were identified during the surveys.

Mitigation Measures:

- If owls are located within the Assessment Area, Protected Activity Centers (PAC) would be delineated around the nest or roost site by SUIT biologists and the FWS.
- Development activities would be restricted within a PAC, although they would be evaluated on a project-specific basis (USFWS 1995).

Conclusions and Determination:

- There is suitable foraging habitat within the Assessment Area which may be impacted by the proposed activities.
- There is no suitable nesting habitat within the Assessment Area.
- No owls have been located on the Southern Ute Indian Reservation.
- Mitigation measures have been designed to minimize impacts, if owls are located within the Assessment Area.

It is my professional determination that the oil and gas development on the Southern Ute Indian Reservation may affect and is not likely to adversely affect the Mexican spotted owl.

Species: **Colorado pikeminnow** (*Ptychocheilus lucius*)
Razorback sucker (*Xyrauchen texanus*)

Status: Federally Endangered

Potential to Occur in Assessment Area: The razorback sucker and Colorado pikeminnow are listed as endangered by the FWS. They will be analyzed together for purposes of this analysis. Neither species is known to occur within the Assessment Area. Critical habitat has been designated downstream in the San Juan River for both species.

There is a small reproducing population of Colorado pikeminnow in the San Juan River, downstream from Shiprock, New Mexico. During 1991 surveys, nine pikeminnow were captured 5 miles upstream from Shiprock.

The razorback sucker occurred historically in the lower Animas River. During a 1987 - 1990 study, suckers were observed within the San Juan River Basin in the vicinity of Lake Powell.

Analysis of Effects: Impacts to the Colorado pikeminnow and the razorback sucker have the potential to occur through water depletion and contamination of the San Juan River. As described in the Intra-Service Section 7 Consultation for Minor Water Depletions of 100 Acre-feet or Less From the San Juan River Basin (1999), the FWS concluded that "water depletions reduce the ability of the river system to provide the required water quantity and hydrologic regime necessary for recovery of the fishes". Water depletions can restrict the ability of the San Juan River to produce flow conditions necessary for the life stages of these fish.

Coalbed methane drilling and completion, as proposed, would require, in total, approximately 29 acre-feet per year of water that would typically be taken from irrigation ditches connected to the Animas, Pine, and Florida Rivers. This drilling and completion water would be recycled to a certain extent, but for the purposes of this analysis it is assumed that it would be lost from the system. In addition, existing coalbed methane wells in the Indian Creek area will continue to produce 37 acre-feet per year of water that would normally discharge to the Animas River or Basin Creek, but instead is pumped into deep formations or evaporation ponds. Therefore, a total of 66 acre-feet per year would be depleted from the San Juan River system as a result of the proposed action. Please see Appendix A for a water depletion summary (Janowiak 2001).

Surface and ground water quality have become a significant concern in the Animas, La Plata, Mancos, and San Juan drainages (USFWS 1994). Increased loading of the San Juan River and its tributaries with soil salts, elemental contaminants, and pesticides from irrigation return flows could potentially degrade water quality and harm fish within the system (USFWS 1994). Contamination to ground and surface water is unlikely as a result of this proposed action. Petroleum spills may occur but safety precautions are in place to keep these types of accidents to a minimum. In the event of a spill, procedures would be implemented to contain hazardous materials and decrease the likelihood that contaminated materials reach ground and surface water.

Potential impacts also include contamination by polynuclear (or polycyclic) aromatic hydrocarbons (PAH), which are a class of organic chemicals that are present in the environment from natural and anthropogenic sources. Relatively few (less than 50) are known to be toxic, mutagenic, teratogenic, or carcinogenic (Odell 1997). Sources of PAH production include: forest fires, agricultural burning, combustion engines, coal-fired energy generation, municipal and industrial waste discharge, stormwater run-off from streets and roads, and spills of both crude and refined petroleum and

hydrocarbon products (Odell 1997). Polynuclear aromatic hydrocarbons have low water solubility and there is a low potential for mobilization via dissolution in surface or ground water. PAHs are found in sediments, aquatic biota, and the water column. PAHs in sediment are often found in concentrations 1000 or more times than in the water column (Abell 1994). They can be ingested by fish through their food or by ingesting the sediment itself. Concentrations of PAH have been found in fish but studies have been unable to draw direct correlations to anthropogenic sources (Joel Lusk, U.S. Fish and Wildlife Service, Albuquerque Field Office, pers. comm). Although no studies have unequivocally linked PAH contamination to fish disease, high incidences of tumors and other abnormalities have been documented in areas of PAH contamination (Abell 1994).

Mitigation Measures:

- Use Best Management Practices to avoid contamination of local streams and rivers.

Conclusions and Determination:

- Best management practices would be used to prevent sediment from reaching streams.
- Spill prevention measures would be implemented to contain hazardous materials and decrease the likelihood of contaminated materials reaching ground or surface water.
- Approximately 29 acre-feet per year would be used for drilling and completing wells. This water would be taken from irrigation ditches for the drilling. This water would be reused during other phases of construction.
- Approximately 37 acre-feet per year would be used during the production phase. This water would be intercepted by producing wells in the Indian Creek area from the Animas River recharge.
- The water is eventually disposed of into deep formations and would not discharge into the Animas river as it normally would. This is considered a depletion within the San Juan River system.
- The project involves minor depletions in the upper San Juan Basin. Therefore, it contributes to the cumulative effect on Colorado Pikeminnow and razorback sucker and constitutes a "may affect and likely to adversely affect" determination for these endangered fish species.

It is my professional determination that the oil and gas development on the Southern Ute Indian Reservation <u>may affect and is likely to adversely affect</u> the Colorado pikeminnow and razorback sucker.

<u>Species</u>: **Knowlton's cactus (*Pediocactus knowltonii*)**

<u>Status</u>: Federally Endangered

Potential to Occur in Assessment Area: The Knowlton's cactus occurs in piñon-juniper woodland with black sage (*Seriphidium novum*) in association with rocky alluvial soils at approximately 6,300

feet elevation. This species is one of the rarest of the genus and one of the rarest plants in the United States with collecting by hobbyists one of the factors contributing to its decline (Ecosphere 1995). The main population occurs near the New Mexico border, and other small populations are present on the Reservation. Because of possible collecting losses, specific locations of these populations are not provided in order to protect the species.

Analysis of Effects: Surface disturbing activities from gas and oil development would directly affect individual plants or populations. Within the pinon-juniper vegetation type, approximately 1,570 acres (1.15%) would be impacted through well pad and right of way development under the Preferred Alternative. Using existing well pads would reduce the disturbance to 1,318 acres (0.97%).

Cumulative Effects: Based on the estimates of surface disturbances from existing oil and gas development within the Assessment Area, the cumulative effect of the Tribal and Agency Preferred Alternative combined with the existing well pad development is anticipated to result in a total surface disturbance of 6,543 acres (4.8 percent of the resource) of piñon-juniper (medium to high density) habitat. Other cumulative effects, though difficult to quantify, could result from residential and other forms of development within piñon-juniper habitat within the Assessment Area, as well as from additional oil and gas and other development outside the Assessment Area.

Mitigation Measures:

- Conduct field surveys as part of the BA process prior to all construction activities.
- Avoid plants and populations which may be impacted by activities.
- Use existing rights-of-way when possible.

Conclusions and Determination:

- Field surveys would be conducted prior to construction activities.
- Plants and populations located during the surveys would be avoided. However, individual plants could go undetected and be impacted by well construction activities.

It is my professional determination that the oil and gas development on the Southern Ute Indian Reservation <u>may affect and is not likely to adversely affect</u> the Knowlton's cactus.

<u>**Species:**</u> **Mancos milkvetch** (*Astragalus humillimus*)

<u>**Status:**</u> Federally Endangered

Potential to Occur in Assessment Area: Mancos milkvetch is found on ledges and mesa tops in slickrock communities of the Mesa Verde Group in the Four Corners area. This species has been observed in Montezuma County, Colorado and San Juan County, New Mexico. Mancos milkvetch has not been observed in the Assessment Area, although Mesa Verde Group outcrops are present.

Analysis of Effects: Surface disturbing activities could directly affect individual plants and populations through their removal or habitat destruction. Cumulatively, residential development may occur within the Assessment Area. However, ledges and mesa tops are relatively inaccessible and the likelihood of impacts is quite low. There should be little or no cumulative effects to the Mancos milkvetch.

Mitigation Measures:

- Conduct surveys prior to well pad and rights-of-way construction activities and, unless previously surveyed by the FWS.
- Avoid individuals or populations located during pre-construction surveys.

Conclusions and Determination:

- The Mancos milkvetch has not been located within the Assessment Area.
- Some suitable habitat exists within the Assessment Area.
- Surveys would be conducted prior to all construction activities and the plant would be avoided. However, individual plants could go undetected and be impacted by well construction activities.

It is my professional determination that the oil and gas development on the Southern Ute Indian Reservation may affect and is not likely to adversely affect the Mancos milkvetch.

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Supplement

to

Biological Assessment
For Oil and Gas Development
On the Southern Ute Reservation

United States Department of the Interior
Bureau of Land Management
Bureau of Indian Affairs

Southern Ute Indian Tribe

Prepared by

Kathleen R. Nickell, Wildlife Biologist
and
James T. Powers, Biological Scientist

San Juan Public Lands Center

March 5, 2002

The following addition information is provided to assist informal consultation between the US Fish and Wildlife Service and Bureau of Land Management regarding the biological assessment for oil and gas development on the Southern Ute Reservation.

SPECIES: Bald Eagle (*Haliaeetus leucocephalus*)

Status of nesting Bald Eagles: We reported in the Biological Assessment (August 27, 2001) that there were three active nest sites within the Study Area, one nest east of Allison and two sites along the Pine River. The following discussion updates the status of these sites and our determination of the potential for coalbed methane (CBM) development within proximity of these sites to impact Gunnison prairie dogs -- a component of the eagles diet:

Site 1- occurs in T32N, R6W, Section 14 approximately 1-2 miles S.E. of Allison and 2 mile north of Navajo Reservoir. Our review of land ownership status indicates that the entire 28 square miles (3 mile radius) surrounding this nest site is composed of private surface and private minerals. Consequently, the BLM, BIA and Tribe have no regulatory authority over development of CBM within this 28 square mile area and no authority to require operators to implement the bald eagle mitigation presented in the Biological Assessment.

For the purpose of quantifying effects to this nest site, our assessment indicates that there are 10 undeveloped drilling windows within this 28 square mile area surrounding the nest site. If each of the 10 available drilling windows were developed, we would predict a total of 31 acres of ground disturbance (3.1 acres per well site) within 3 miles proximity of the nest site. Thus the total impact would represent 2/1000 of the surrounding area (31 acres/18,100 acres = .001).

Site 2 - occurs along the Pine River approximately 1-2 miles south of State Highway 151. Our review of the status of this nest site involved interviews with Southern Ute Agency and Bureau of Reclamation biologists. The nest site was occupied as recently as 4 years ago, but has since blown off of the host cottonwood tree (Terry Stroh, U.S. Bu.Rec., pers. comm., 2001). There are no other nest sites in this vicinity. The area within a 3-mile radius of the old nest site is a combination of private and Tribal minerals (an approximate 50 - 50 mix). There are 11 undeveloped drilling windows within a 3-mile radius of the old nest site. If these 11 drill windows were developed, we estimate a total of 34 acres of ground disturbance would result. This disturbance equals approximately 2/1000 of the area within 3 mile radius of the old nest site.

Site 3 - is located along the pine river approximately half way between Ignacio and Bayfield. This site is also characterized by mixed mineral ownership and is approximately 60 percent tribal minerals, 40 percent private mineral estate. There are 15 undeveloped well windows within a 3-mile radius of this nest site. Development of these 15 well windows would impact 46 acres within a 28 square mile area. This disturbance equals approximately 2/1000 of the area within 3 miles proximity of the nest site. We assume prairie dogs could make up a portion of the eagles opportunistic diet in this location. However, we a re unsure of the dependency of bald eagle on prairie dogs. Stroh (pers. comm. 2001) and Wait (CDOW, pers. comm. 2001) indicated that we can anticipate some amount of eagle foraging of prairie dog within proximity of this nest site, but that we cannot draw inferences that the foraging habits of eagles along the Pine River mirror those of eagles studied east of Allison. Because of the minor acreage of disturbance involved we consider this level of disturbance to result in minimal to no measurable impact to the Eagle=s potential prey base in this location.

Findings: Total ground disturbing impact from gas well development within a three mile radius of the nest sites would equal:

Site 1 -	31 of 18,100 acres
Site 2 -	34 of 18,100 acres
Site 3 -	46 of 18,100 acres
TOTAL	110 of 54,300 acres, or 2/1000 of the total area.

We do not expect prairie dog colonies to be located only where gas development is proposed. Under a reasonable assumption of random and widespread prairie dog colony distribution, the vast majority of prairie dog colonies would be well insulated from development. However, even if the 110 acres of ground disturbance directly impacted 110 acres of prairie dog colonies, we would consider this level of disturbance to result in minimal to no impact to the Eagle=s potential prey base within proximity of the active and abandoned sites.

Additional Mitigation: The following mitigation is added to the Biological Assessment In addition to the mitigation in the August 27, 2001 Biological Assessment:

- Survey proposed well pad and access route locations for Gunnison prairie dog. Avoid directly impacting prairie dog colonies were possible, and in light of other resource tradeoffs resulting from access road and well pad relocation.

Determination: Additional prey base analysis is presented in this Supplement. Mitigation has been designed both in the Biological Assessment and this Supplement to protect active nest sites and prey base. There is no change in the eagle=s determination:

It is my determination that oil and gas development on the Southern Ute Reservation <u>may affect and is not likely to adversely affect</u> the bald eagle.

SPECIES: Southwestern willow flycatcher (Empidonax traillii extimus)

The EIS concludes that a maximum 165 acres of wooded riparian vegetation could be impacted by proposed gas development activities. However, because mitigation calls for avoiding development in riparian areas, the expected level of impact to wooded riparian and riparian areas would be much smaller. Wooded riparian habitat is used as a surrogate for southwestern willow flycatcher habitat because the flycatcher=s habitat is not mapped.

Site-specific biological assessments are required for individual projects where, at such time, the project area is surveyed for suitable habitat and for presence of the southwestern willow flycatcher. During project design, well pads roads and other ancillary facilities will be sited away from locations that contain suitable habitat. To clarify this avoidance measure, the following mitigation is adopted:

- Avoid disturbance to suitable southwestern willow flycatcher habitat by siting facilities a minimum of 100 meters away from such habitat.

Determination: Given the mitigation policy and requirement for suitable habitat avoidance, **it is my determination that oil and gas development on the Southern Ute Reservation <u>may affect and is not likely to adversely affect</u> the southwestern willow flycatcher.**

References:

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Interoffice Memorandum
USDI Bureau of Land Management
San Juan Field Office
FAX (970) 385-1375

8 March, 2001

To: Kurt Broderdorp, US Fish and Wildlife Service

cc: K. Nickell, H.M. Johnson, J. Powers, J. Pecor, K. Hoffman

From: Matt Janowiak

Re: SUIT EIS Water Depletion Summary

This technical summary was prepared as a result of the meeting on 5 February 2001 between the Southern Ute Indian Tribe, Bureau of Land Management (BLM), United States Forest Service (USFS), and the United States Fish and Wildlife Service (USFWS). The USFWS reviewed the Biological Assessment (BA) from the Southern Ute EIS, and had several questions regarding the magnitude of the water depletions associated with oil and gas development on Southern Ute Tribal Lands.

San Juan Basin Hydrology

The San Juan structural basin (not the watershed basin), is typically defined by the outcrop of the Pictured Cliffs sandstone. The 3M Study, sponsored in part by the BLM, modeled the groundwater flow in the Fruitland Formation coalbeds across the entire San Juan Basin. The Fruitland Formation was modeled because recent developments in the understanding of the coalbed methane reservoir showed that the Fruitland Formation is an aquifer, with dynamic groundwater flow. Previously, it was thought that the Fruitland Formation was a sealed reservoir, with no groundwater flow. Some workers even postulated that the water in the coalbeds was connate water, or water that was present in the original depositional environments.

The groundwater flow in the Fruitland Formation occurs in two regimes (Figures 1 and 2). There is a near-outcrop flow system where precipitation falling on the outcrop recharges the aquifers, flows basinward, looping back and eventually discharging to the rivers that cut across the outcrop. Groundwater travel time from the outcrop recharge areas to the river cuts is on the order of 1,000 to 10,000 years over distances of about 4 to 8 miles.

The second regime is a deep basin flow system that receives a small fraction of the recharge water. The deep basin flow system discharges at the western edge of the basin where the San Juan River flows across the outcrop, west of Farmington, New Mexico. The travel times from the outcrop recharge areas to the San Juan River crossing are on the order of 500,000 to 1,000,000 years and more. Groundwater in the deep basin flow system has much higher Total Dissolved Solids (TDS) concentrations, typically greater than 7,500 mg/l and often exceeding 12,000 mg/l (Figure 1). The

higher TDS is caused by the very long times which the water is in contact with rock.

As noted above, the Fruitland Formation is a regional aquifer, with higher permeability than the overlying Kirtland Shale and the underlying Lewis Shale. The Pictured Cliffs Sandstone, immediately underlying the Fruitland Formation, also makes up part of the regional aquifer system along to basin rim. Deeper in the basin, the Pictured Cliffs Sandstone is a gas reservoir, with no groundwater flow.

Even though the Fruitland/Pictured Cliffs are described as an aquifer, the overall groundwater flow through these formations is quite low due to the low overall permeability and low recharge potential.

The 3M groundwater flow model has quantified the Fruitland groundwater discharge at the rivers crossing the outcrop (Table 1).

RIVER	Fruitland Discharge (cubic ft/day)	Fruitland Discharge (acre-feet/year)
La Plata	250	2.1
Animas River & Basin Creek	8,819	73.9
Florida River	3,650	30.6
Los Pinos (Pine) River	7,239	60.6
Piedra River & Stonesteimer Creek	3,544	29.7
San Juan River (East)	3,263	27.3
San Juan River (West)	1,890	15.8
Navajo River	248	2.1
Rio Puerco	4,587	38.4
TOTAL DISCHARGE	24,803	280.5

As shown in Figure 2, the discharge to the Florida, Pine, Animas, and Piedra Rivers comes from the near-outcrop groundwater flow system. The discharge to the San Juan and La Plata Rivers is from the deep basin flow system.

Figure 2 also illustrates the relationship between the Southern Ute Indian Reservation and the two groundwater flow regimes. Immediately evident is that a small portion of the reservation overlaps the near-outcrop flow regime that discharges to the Animas River. The recharge area on the reservation is called the Indian Creek Area, and it is the only high-elevation recharge area on the Southern Ute Indian Reservation with Fruitland Formation and Pictured Cliffs outcrops along Basin Mountain and Bridge Timber Mountain. South of Bridge Timber Mountain the elevation of the Fruitland Formation and Pictured Cliffs outcrops drops considerably. Along with this drop in elevation comes a corresponding drop in mean annual precipitation on the outcrop. As a result, the Fruitland Formation and Pictured Cliffs Sandstone provide very little recharge to the near-outcrop flow regime on the reservation.

As shown in Table 1, 73.9 acre-ft/yr discharges from the Fruitland Formation to the Animas River. Only a portion of this discharge is sourced from the recharge areas on the reservation. The remainder comes from the recharge areas east of the Animas River, north of the reservation.

Potential Coalbed Methane Depletions of Water – Basin Wide Development (Colorado and New Mexico)

Depletion to surface flows is mostly related to the near-outcrop flow regime. Recall that the deep basin flow regime is operating on 100,000 to 1,000,000 time scales, and that injection of Fruitland water into deeper zones will simply redistribute the water, without affecting the overall flows.

The majority of Fruitland water that discharges to the rivers is from the near-outcrop flow regime. The only deep basin discharge point appears to be where the San Juan River crosses the Fruitland outcrop along the western rim of the basin. At this point, about 16 acre-ft/yr are discharged.

Coalbed methane water production exceeds the recharge potential of the Fruitland and Pictured Cliffs Formations. Exactly how much excess water is produced is not known at this time. However, the water balance is negative, with vastly more water produced than recharged. Just in the Colorado portion of the San Juan Basin, produced water exceeds recharge by a factor of 4.

The 3M study characterized basin recharge to the Fruitland coalbeds. The model showed a good fit with about 280 acre-ft/yr of recharge throughout the entire basin. This model did not account for the recharge in the Pictured Cliffs Formation, which could be similar to the Fruitland recharge rates.

Pictured Cliffs contribution to streamflow at individual rivers is unknown at this time.

Potential Coalbed Methane Depletions of Water – Southern Ute Indian Reservation Development

Oil and gas development on the Southern Ute Indian Reservation only affects the near-outcrop groundwater flow system in the Indian Creek Area. By operating coalbed methane wells in the Indian Creek Area, the 37 acre-ft/yr of water that would normally discharge to the Animas River or Basin Creek are intercepted and disposed of into deep formations or evaporation ponds.

Disposal of water into deep formations takes the water out of the near-outcrop system and places this water into the deep basin flow system. In effect, the water taken from the near-outcrop flow regime is taken out of circulation for hundreds of thousands of years, and it can be considered a depletion of water within the San Juan River system.

Additional depletion of surface flow may occur by intercepting the groundwater flow in the Pictured Cliffs Sandstone. The amount of additional depletion from Pictured Cliffs groundwater interception is unknown, but a study is underway to quantify this term.

Future Work

Questions that remain unresolved are:

1. Given that the Pictured Cliffs and Fruitland Formation act as an aquifer, how much Pictured Cliffs recharge is being intercepted by the Fruitland Coalbed

Methane wells? Our current understanding of recharge rates indicates that recharge in the Pictured Cliffs may be <1 to 4 times than on the Fruitland outcrop. Better quantification of Pictured Cliffs recharge potential is required.

2. In the future, as reservoir pressures decline, how much water can be lost from the rivers into the Pictured Cliffs and Fruitland Formations? As the Fruitland and Pictured Cliffs Formations are dewatered the hydraulic gradient between the river and these formations will reverse. This will change the rivers from gaining streams to losing streams as they cross the outcrop. The magnitude and timing of these changes in stream-aquifer relationships are unknown. However, it can be said that stream flow depletions by oil and gas activities on the reservation will be limited to the Animas River/BasinCreek area because the other river crossings are over 6 miles from the reservation boundary.
3. Is there a beneficial use for the produced water within the basin that regulatory agencies can agree to?

Questions 1 and 2 above are being addressed by a study funded by the Ground Water Protection Council. This study was started in October 2000 and is scheduled for completion in September 2001. Results of this study will be made available to the Fish and Wildlife Service upon completion.

Question 3 was the subject of BLM proposal to the Ground Water Protection Council. Should this project be funded, the BLM will work closely with the USFWS throughout the execution of the feasibility study for beneficial uses of the produced water.

Figure 1

Total Dissolved Solids in Groundwater, Fruitland Formation, San Juan Basin, Colorado

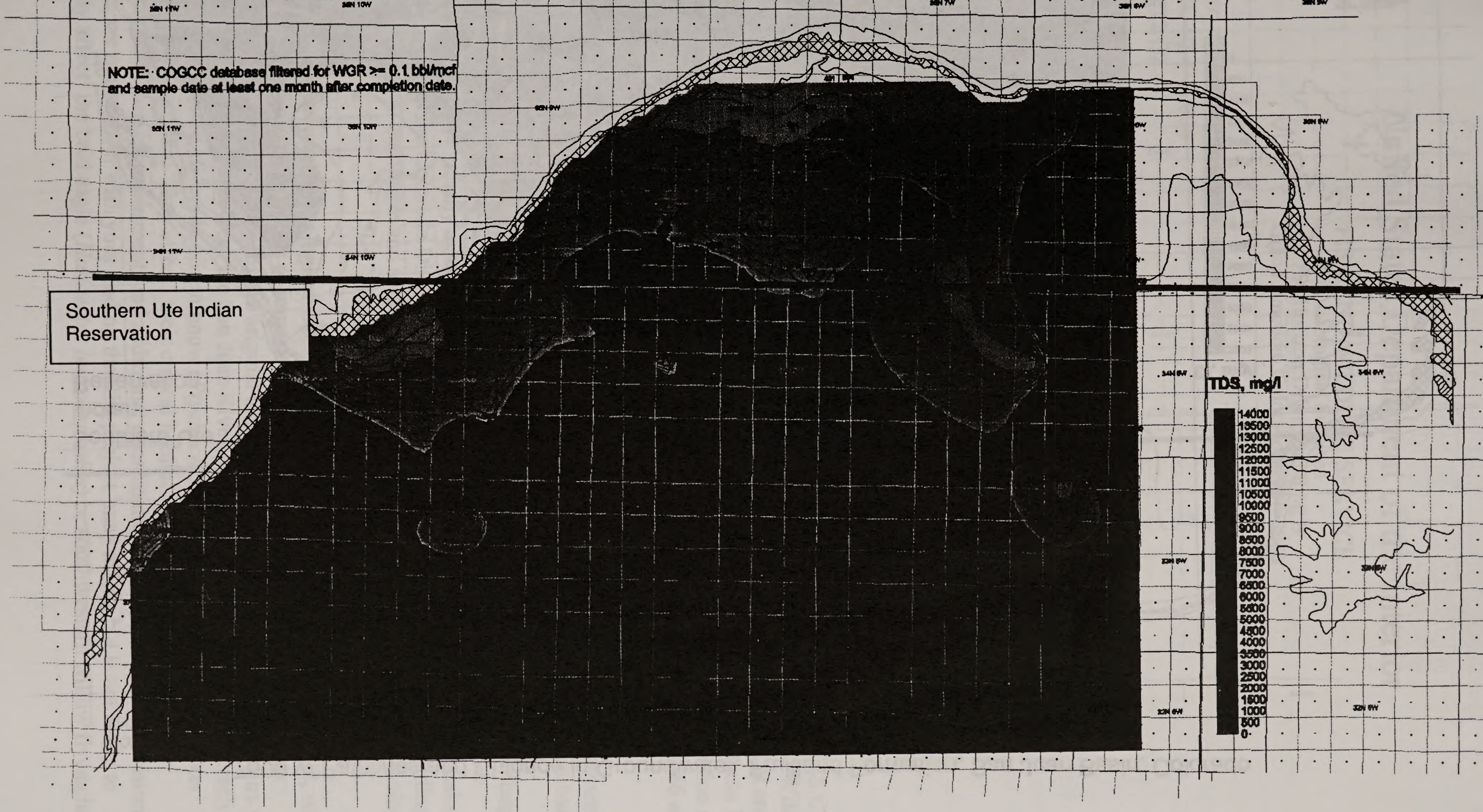
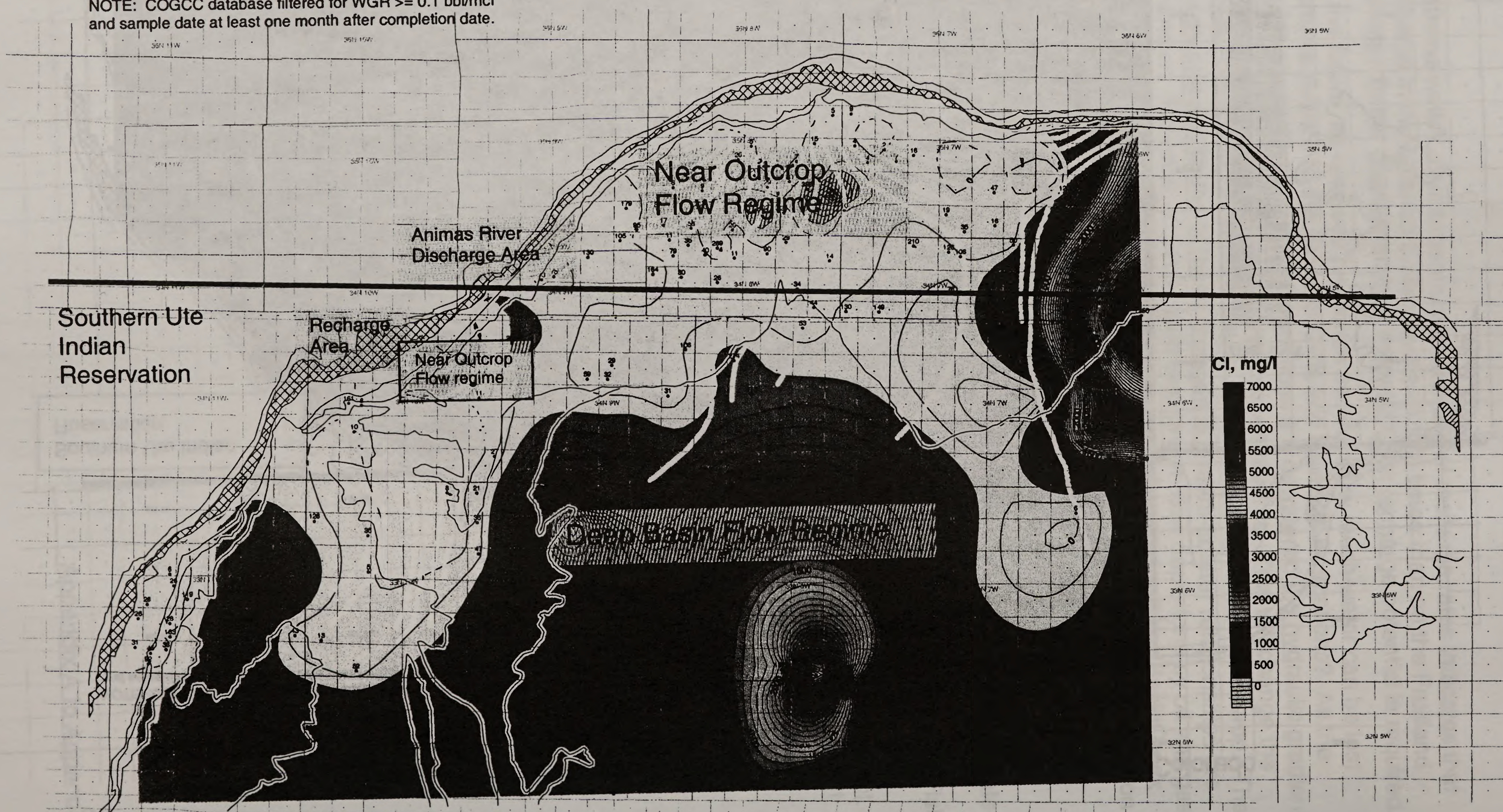


FIGURE 2

7500 yr Pathlines and Chloride in Groundwater, Fruitland Formation, San Juan Basin, Colorado

NOTE: COGCC database filtered for WGR >= 0.1 bbl/mcf and sample date at least one month after completion date.



United States Department of the Interior

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Ecological Services
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946

IN REPLY REFER TO:
ES-6-RO-02-F-SJ004
MS 65412 GJ

March 20, 2002

Calvin N. Joyner, Forest Supervisor/Center Manager
Bureau of Land Management
San Juan Public Lands Center
15 Burnett Court
Durango, Colorado 81301

Dear Mr. Joyner:

In accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), and the Interagency Cooperation Regulations (50 CFR 402), the Fish and Wildlife Service reviewed your August 27, 2001, correspondence regarding the impacts of the Oil and Gas Development on the Southern Ute Indian Reservation Project on endangered Colorado River fishes. The project is located in numerous sections on the Southern Ute Indian Reservation in southwestern Colorado. The proposed action will cause an average annual depletion of 66 acre-feet to the San Juan River.

Reference is made to your August 27, 2001, cover letter, with attached biological assessment, requesting initiation of formal consultation for the project. Based on this consultation initiation date, the formal consultation should have been completed by us on November 25, 2001. However, following receipt of the biological assessment, we notified your staff that we disagreed with the findings in the biological assessment for the bald eagle and southwestern willow flycatcher, and it was mutually agreed that additional information was necessary. Discussions with your staff and the Colorado Division of Wildlife have therefore been ongoing regarding potential impacts to bald eagle and southwestern willow flycatcher since receipt of the biological assessment.

We received a supplemental biological assessment from your office dated March 5, 2002, which provides a more thorough analysis of impacts to the bald eagles and southwestern willow flycatchers. Based on our review of the original biological assessment, the Service concurs that the annual depletion of water from the San Juan River "may affect, and is likely to adversely affect" the endangered Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*) and "may affect" their critical habitat. Based on our review of the supplemental biological assessment, and additional coordination with the Colorado Division of Wildlife, we now concur with your finding that the project 'may affect, but is not likely to adversely affect' the bald eagle (*Haliaeetus leucocephalus*) or southwestern willow flycatcher

(*Empidonax traillii extimus*). We also concur that the project is not likely to adversely affect the Mexican spotted owl (*Strix occidentalis lucida*), *Pediocactus knowltonii* (Knowlton's cactus), and the *Astragalus humillimus* (Mancos milk-vetch). We agree there are no other federally listed species known or likely to occur within the assessment area. As water depletion is now the only adverse impact associated with the project, we are able to provide this streamlined section 7 consultation.

A Recovery Implementation Program for Endangered Fish Species in the San Juan River Basin was initiated in October 1992. The Recovery Program was intended to be the reasonable and prudent alternative to avoid jeopardy to the endangered fishes by depletions from the San Juan River.

On May 21, 1999, the Service issued a biological opinion determining that depletions of 100 acre-feet or less would not limit the provision of flows identified for the recovery of the Colorado pikeminnow and razorback sucker and, thus, not be likely to jeopardize the endangered fish species or result in the destruction or adverse modifications of their critical habitat.

The Bureau of Land Management should condition its approval documents to retain jurisdiction in the event that the Recovery Program is unable to implement the flows identified for recovery in a timely manner. In that case, as long as the lead Federal Agency has discretionary authority over the project, reinitiation of section 7 consultation may be required.

We appreciate the Bureau of Land Management's attention to the conservation needs of the bald eagle and southwestern willow flycatcher.

Sincerely,

Allan R. Pfister

Allan R. Pfister
Assistant Colorado Field Supervisor

cc: CDOW, Durango
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BLeachman:SUteOilGasSJBO.wpd:032002

APPENDIX H
GENERALIZED STRATIGRAPHIC COLUMN OF SOUTHERN UTE INDIAN RESERVATION

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit	Lithology	Thickness and Distribution	Depositional Environment	Use	
					San Juan Basin	Four Corners Platform
Quaternary	Floodplain Deposits	Sand and gravel with clay, silt, and boulders; generally poorly sorted.	Up to 50 feet; in valleys of present-day streams; thinnest in the western part of the Study Area in the La Plata and Animas river valleys (Brogden and others 1979).	Originating from erosion of the La Plata Mountains (northwest of the Study Area).	Water-bearing	Water-bearing
Quaternary	Terrace deposits	Sand and gravel with clay, silt, and boulders; poorly sorted, with coarser materials well rounded.	Up to 100 feet; two large, extensive terrace deposits in the Study Area. The westernmost, between the towns of Redmesa and Breen in the La Plata River valley, is between 80 and 100 feet thick. The Florida Mesa, between the Animas and Florida rivers, is 60 feet thick.	Originating from erosion of the La Plata Mountains (northwest of the Study Area).	Water-bearing	Water-bearing
Tertiary	San Jose Formation	Interbedded arkosic sandstones, siltstones, and variegated shales (Levings and others 1990).	Overlies the Animas Formation in the northern and eastern portion of the Study Area and the Nacimiento Formation in the southwestern portion of the Study Area. About 1,000 feet thick a few miles south of Durango but is typically as much as 2,000 feet thick elsewhere within the Study Area except where eroded or downcut by the major river valleys (Aubrey 1991).	Sandstones and conglomeratic sandstone are fluvial in origin with the formation generally much sandier in the northern part of the basin than the southern suggesting a northern source.	Water-bearing	Water-bearing

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit	Lithology	Thickness and Distribution	Depositional Environment	Use	
					San Juan Basin	Four Corners Platform
Tertiary	Nacimiento Formation	Nonresistant shale and very fine-grained sandstones. The shale is generally gray, although locally it is variegated red, white, and gray, especially near the top of the formation. The sandstone is yellow, greenish gray, or tan and quartzose and well sorted.	Uplift mainly west of the Animas River and east of the Hogback monocline; generally grades laterally into the upper part of the Animas Formation to the north; however, locally upper beds of the Nacimiento overstep steeply dripping beds of the upper part of the Animas Formation. The Nacimiento is approximately 1,450 feet thick at the Colorado-New Mexico state line and generally thins to the south (Aubrey 1991).	Variety of alluvial environment including channel, floodplain, alluvial fan, and lacustrine environments. Streamflow was from the north and east and the Nacimiento sediments are coarser in the northern part of the San Juan Basin than the southern part.	Water-bearing, gas	Not present

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Tertiary	Animas Formation	Upper part	Lower conglomeratic sequence grading into a sand and shale sequence with thin carbonaceous and coaly shales; characteristically olive, brown, or various shades of gray.	Occurs in the northern and northeastern parts of the San Juan Basin and is 1,200 feet thick at the Animas River near Durango and 2,670 feet thick near the La Plata-Archuleta county line.	Intraformation angular unconformities and conglomeratic lithologies within the upper part of the Animas as well as overstepping relations of the upper part of the Animas with underlying units suggest syntectonic deposition by alluvial fans. Source of the fans appear to be from a northern source area probably derived from the northwest San Juan and Needle mountains and from the northeast Brazos-Sangre de Cristo uplift.	Water-bearing, gas shows	Not present

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit	Lithology	Thickness and Distribution	Depositional Environment	Use	
					San Juan Basin	Four Corners Platform
Tertiary	Ojo Alamo Sandstone	Medium to coarse-grained, crossbedded sandstone and pebbly sandstone that locally contains lenses of claystone and siltstone. The pebbles diminish in size from north to south and from west to east. The sandstone consists of lenticular bodies as much as 49 feet thick and more than 0.6 mile long that are separated by thin shale interbeds and scour surfaces.	Typically 20 to 400 feet thick in the region. The Ojo Alamo Sandstone is missing from the northern part of the San Juan Basin and is generally absent from southwestern Colorado.	Probably originally deposited in the northern areas but was later uplifted and eroded (Aubrey 1991). The Ojo Alamo deposited by sandy braided streams on a broad alluvial plain (Fassett and Hind 1971). Paleocurrent directions indicate a northern source and volcanic fragments in the Ojo Alamo also indicate a northern source in volcanic fields in the San Juan Mountains region. The base of the Ojo Alamo is generally a scour surface although locally it is gradational or interfingers with the underlying Kirtland Shale (Aubrey 1991).	Water-bearing, gas shows	Not present

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Upper Cretaceous	Animas Formation	McDer-mott Member	Very coarse breccia, volcanic conglomerates, coarse tuffaceous sandstones, shales, and thick beds of massive fine- to coarse-grained tuff with andesite cobbles and pebbles. The rocks are generally reddish brown to purple and consist of andesitic debris with lesser amounts of quartz, quartzite, and chert. Andesite boulders occur locally in the lower beds of the member and large cobbles and pebbles of andesite occur in the upper beds. The size of the andesitic boulders decrease south of McDermott Arroyo in the western part of the Reservation locally.	Variable; in general the member thins to the southeast ranging from 290 feet thick in the western part of the Study Area 15 miles south of Durango to 127 feet thick near the Colorado-New Mexico state line. Intertongues with both the underlying Upper Cretaceous Kirtland Shale and the overlying Paleocene upper part of the Animas Formation.	Probably fluvial in origin, although some conglomeratic layer that coarsen upward may have originated as mudflows. The McDermott becomes thinner and less coarse to the southeast which suggests a source to the northwest. Andesitic debris may have originated in volcanoes located in the region of the present-day La Plata Mountains.	Water-bearing, gas shows	Not present

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit	Lithology	Thickness and Distribution	Depositional Environment	Use	
					San Juan Basin	Four Corners Platform
Upper Cretaceous	Kirtland Shale	Thick sequence of shales with some sandstones. The Kirtland is divided into three members with the upper and lower members predominately shale and the middle member predominately sandstones (called the Farmington Sandstone Member) (Aubrey 1991). Upper shale member consists of shale and interbedded lenses of nonresistant friable sandstone. The shale is similar to the shale in the lower member and the sandstone is generally light yellowish white and locally conglomeratic. The upper cable member also contains abundant intermediate volcanic fragments. The Farmington Sandstone Member is a sequence of resistant pale olive, dusky yellow, and grayish orange, fine to medium grained, and crossbedded sandstones that are separated by beds of	Regionally the Kirtland shale thins from the northwestern part of the San Juan Basin to the southeastern part where it is locally absent. Within the Study Area the thickness of the Kirtland Shale ranges from 1,065 feet on the western side of the Study Area near the Colorado-New Mexico border to 1,200 feet near Durango.	The Kirtland Shale is an alluvial deposit. Siltstone and mudstone probably represent overbank floodplain deposits and sandstone probably represents deposition in stream channels (Fassett and Hinds 1971). During most of the late Cretaceous, shorelines trended northwest-southeast and paleoslopes dipped to the northeast. A change in paleoslope from the northeast to the southwest may have occurred during the deposition of the upper member of the Kirtland Shale. Additionally the presence of volcanic fragments in the upper member indicate a source from the San Juan Mountains, the only regional volcanic source at the end of the Cretaceous, on the northern perimeter of the basin. The change in dip of the paleoslope during Kirtland deposition is the first major tectonic event of the Laramide orogeny in the region.green or	Some water near the Hogback , gas	Not present

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit	Lithology	Thickness and Distribution	Depositional Environment	Use	
					San Juan Basin	Four Corners Platform
Upper Cretaceous	Fruitland Formation	Interbedded sandstones, siltstones, shale, carbonaceous shales, carbonaceous sandstones and siltstones, and coal (Fassett and Hinds 1971). Sandstones, which are commonly gray, brown, or olive, fine to medium grained, quartzose, well indurated, and crossbedded, are more abundant in the lower than the upper part of the formation. Sandstones and shales are discontinuous and interfinger with one another, whereas the coal is more continuous and locally traceable for several miles. The thickest coal deposit within the external boundaries of the Reservation can be found a few miles south of Durango and consists of 80 feet of thin coal beds separated by numerous thin partings (Fassett 1988; Fassett and Hinds 1971). The depositional strike of the Fruitland coals is northwest-southeast. The coals	About 500 feet thick in the northwest portion of the Study Area (Aubrey 1991; Fassett 1988).	The Fruitland Formation consists of coastal-swamp, alluvial, and lacustrine deposits that accumulated inland of the prograding and aggrading shoreline deposits of the Pictured Cliffs Sandstone (Fassett and Hinds 1971). The interfingering nature of the Fruitland and the Pictured Cliffs is due to minor local transgressions and regressions of the Cretaceous shoreline due to the sediment supply versus subsidence balance and/or minor austatic sea level changes. The Fruitland coals have been mapped into three coal zones and appear to be associated with three stalling episodes within the regression of the Pictured Cliff shoreline (Sandberg 1988). The lowermost zone contains the thickest coalbeds.	Gas, coal, water-bearing, near the Hogback	Not present are arranged en echelon and rise 1,200 feet stratigraphically from southwest to northeast.

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit	Lithology	Thickness and Distribution	Depositional Environment	Use	
					San Juan Basin	Four Corners Platform
Upper Cretaceous	Pictured Cliffs Sandstone	Upper medium to thick bedded ledge forming sandstone and a lower thin bedded very fine-grained sandstone with interbedded shales and siltstones (Fassett and Hinds 1971). Locally stratigraphic rises occur abruptly and the Pictured Cliffs forms northwest-southeast-trending benches.	Ranges in thickness from 285 feet in the western portion of the Study Area near the Colorado-New Mexico state line to 215 feet near Durango (Aubrey 1991) and rises stratigraphically from the southwest to the northeast.	Represents the final Cretaceous regressive (R-5) shoreline within the Study Area (Fassett 1988); shoreline sandstone primarily in shallow-water, marine; benches also represent times of relative shoreline stability.	Gas, oil, water-bearing near the Hogback	Not present
Cretaceous	Lewis Shale	Thick sequences of light- to dark-gray and black shale with interbeds of fine-grained sandstone, limestone, calcareous concretions, and bentonite (Fassett and Hinds 1971). Bentonite marker beds that give distinctive responses on electric logs include the "Green Marker Horizon" near the base of the Lewis and the Huerfanito Bentonite Bed in the upper part of the Lewis (Aubrey 1991). The Lewis Shale is wedge-shaped with the wedge pointing toward the southwest.	Maximum thickness within the Study Area of approximately 2,400 feet (Fassett and Hinds 1971) conformable with and grades both laterally and vertically into the underlying Cliff House Sandstone and the overlying Pictured Cliffs Sandstone.	Represents the last Cretaceous sea (T-5 transgression and R-5 regression) in the Study Area.	Gas	Minor water near the Hogback

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Cretaceous	Mesa Verde Group	Cliff House Sandstone	Very fine to fine-grained crossbedded sandstone sequence massive or interbedded with shale and siltstones (Aubrey 1991).	About 400 feet in the Mesa Verde area to little or no sandstone present interfingers laterally and vertically with the overlying marine Lewis Shale and the underlying deltaic deposits of the upper coal member of the Menefee Formation.	Transgressive (T-5) shallow-marine sandstone that was deposited primarily in the lower to upper shoreface zone of a barrier-island beach front. Thick sandstone benches or sandstone tongues were probably deposited during time of relative shoreline stability. Shoreline deposits generally trend northwest-southeast (Aubrey 1991).	Gas, oil, under-ground water disposal	Water-bearing
Cretaceous	Mesa Verde Group	Menefee Formation	Shale, carbonaceous shale, coal, and siltstones alternating with lenticular beds of sandstone. Total Menefee coal thickness in the northern part of the basin measures approximately 10 feet, consisting of a maximum 4-foot-thick lower and a maximum 6-foot-thick upper coalbeds.	Thins to the northeast and pinches out in the eastern part of the Reservation. West of the Reservation the Menefee ranges in thickness from about 800 feet near the Colorado-New Mexico state line to about 340 feet in the northern part of the Mesa Verde area.	Relatively thick, lenticular crossbedded sandstones are probably channel sandstones deposited by meandering streams; thin sandstone beds represent crevasse-splay or levee deposits; and shale and coalbeds represent nonchannel floodplain deposits. Coal-bearing portions (lower and upper) were probably deposited on the middle or lower part of a delta plain. Coal-barren portions were probably deposited on a continental fluvial plain or on the upper to middle part of a delta plain.	Gas	Gas, coal

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Cretaceous	Mesa Verde Group	Point Lookout Sandstone	Consists of two members, the lower sandstone and shale member and the upper massive sandstone member. The sandstone and shale member is composed of interbedded yellowish-gray, fine-gained, cross-laminated sandstone and sandy dark-olive-gray, fossiliferous shale. The amount of sand in the member increases upward. The upper massive sandstone consists of thick to massive beds of light-gray to yellowish-gray, crossbedded, fine- to medium-grained sandstone.	The lower member is about 80 to 125 feet thick in the Mesa Verde area, but elsewhere in the northern part of the basin it is as thick as 250 feet. The upper massive sandstone is about 200 to 250 feet thick. The Point Lookout Sandstone rises stratigraphically from the southwest to the northeast and grades laterally as well as vertically into both the underlying Mancos Shale and overlying Menefee Formation.	Variety of coastal, shoreline environments. Benches or abrupt stratigraphic rises represent stacking of shoreline deposits when the shoreline was relatively stable. Benches in the northwestern San Juan Basin form thick sandstone bodies that continue for many miles in a northwest-southeast direction (Aubrey 1991).	Gas, oil, under-ground water disposal	Water-bearing, gas

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit	Lithology	Thickness and Distribution	Depositional Environment	Use	
					San Juan Basin	Four Corners Platform
Cretaceous	Mancos Shale	Gray to dark-gray, gypsiferous, marine shale. A regional unconformity of Coniacian age divides the Mancos Shale into upper and lower parts (Figure 3.4-3). Many thin, platy sandstone beds interbedded with sandy shale are located at this unconformity. The 400 to 500 feet of shale directly above the unconformity has variable carbonate content. The remainder is less calcareous and in its upper part grades into the overlying Point Lookout Sandstone (Molenaar 1991).	Approximately 1,500 feet of Mancos Shale overlies the Coniacian unconformity. The Tocito Sandstone Lentil of the Mancos Shale crops out on the western side of the San Juan Basin to the west and south of the Reservation. Although the Tocito Sandstone Lentil does not crop out on the Reservation, it may occur locally in the subsurface.	Marine deposits include all the rocks between the transgressive Dakota Sandstone (T-1) and the regressive Point Lookout Sandstone (R-4) (Figure 3.4-3); not homogenous and changes in lithology within the Mancos in the Reservation reflect transgressions and regressions of the shoreline that occurred to the southwest. The Tocito was deposited during the T-3 transgression and some have interpreted thick sandstones in the Tocito to represent offshore-bar deposits.	Oil and gas	Oil and gas

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit	Lithology	Thickness and Distribution	Depositional Environment	Use	
					San Juan Basin	Four Corners Platform
Cretaceous	Dakota Sandstone	Sand, shale, minor conglomerates, and coal. White, light- to medium-gray, and yellowish-brown conglomerate, conglomeratic sandstone, and fine- to medium-grained sandstone; grayish-green to grayish-red, generally nonbentonitic, hackly weathering mudstone, dark to medium-gray carbonaceous mudstone and siltstone and minor interbedded coal.	Thickness with the underlying Burro Canyon, undivided, ranges from 180 to 270 feet and averages 200 feet.	Deposited in response to the initial transgression (T-1) of the Upper Cretaceous epieric sea. Basal alluvial unit, Encinal Canyon Member, that is overlain by deltaic, marginal-marine, and marine rocks in different parts of the region. In general, Upper Cretaceous shorelines trended northwest-southeast and transgressed to the southwest; however, during the middle Cenomanian a large embayment, the Seboyeta Bay, formed in the northwestern New Mexico and the shoreline in the Reservation area trended north-south and transgressed to the west.	Gas, minor oil	Oil, gas, minor water

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Lower Cretaceous	Burro Canyon Formation		Lenticular conglomerate and conglomeratic fluvial-channel sandstone bodies composed of quartzose sandstone and pebbles of colored chert, quartzite, silicified limestone, and siltstone. The conglomeratic sandstones are more numerous, less coarse, and more "blanketlike" in the upper part of the section than the lower part.		Fluvial-channel		
Jurassic	Morrison Formation	Brushy Basin Member	Light-greenish-gray to reddish-brown, smectitic mudstone; very fine-grained sandstone; and minor amounts of conglomeratic sandstone, limestone, and the aeolites anaclime and clinoptilolite.	Less than 200 feet thick across much of the Reservation but thickens to more than 300 feet in the Piedra River area.	Fluvial and lacustrine origin (Condon 1992). Playa-lake complex deposited in a basin that extended from the southern edge of the present-day San Juan Basin to the north of the present-day Uncompahgre Uplift. Zeolites originated from volcanic ash that came from a magmatic arc several hundred miles to the west (Aubrey 1991).	Gas	Gas and oil

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Jurassic	Morrison Formation	West Canyon Member	Tan, light-gray, and yellowish-brown, fine- to medium-grained, crossbedded sandstone and light greenish-gray to dark-gray mudstone and becomes more mudstone dominated eastward into the Reservation in the subsurface.	Up to 160 feet thick, thinning to the north, on the Reservation.	Part of an alluvial complex that prograded from a source area southwest of Colorado.		
Jurassic	Morrison Formation	Recapture Member	White to light-gray, fine-grained sandstone and reddish-brown to pale-green mudstone.	About 50 to 100 feet thick.	Fluvial unit.		
Jurassic	Morrison Formation	Salt Wash Member	Light-gray, yellow, and tan, fine- to medium-grained lenticular crossbedded sandstone and greenish-gray to reddish-brown mudstone. More mudstone dominated eastward into the Reservation in the subsurface.	Averages 100 to 150 feet.	Extensive alluvial complex which was composed of sediments shed from highlands to the west.		

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Jurassic	Junction Creek Sandstone (equivalent to the Bluff Sandstone Member of the Morrison Formation) recognized in Utah, Arizona, and New Mexico.		The formation is divided into three units. The lower most unit is equivalent with the Horse Mesa Member of the Wanakah Formation. Middle unit of the Junction Creek consists of pink to orange, fine- to medium-grained sandstone. The middle unit is thick to very thick bedded and has very large scale crossbedded cosets. The upper unit is grayish-red, fine-grained, argillaceous sandstone.	The middle unit is about 250 feet thick in McElmo Canyon and generally thins eastward in the subsurface. The thickness of the upper unit is variable; 30 feet in McElmo Canyon. The middle and upper units of the Junction Creek thin to 100 feet or less at the surface in the Piedra River area.	Eolian environments which varied from dune to interdune-playa (Condon 1992).	Under-ground water disposal	
Jurassic	Wanakah Formation	Horse Mesa Formation	Pale-red to reddish-brown, fine- to medium-grained sandstone. Coarse grains of white chert are locally abundant; alternating flat-bedded and crossbedded cosets.	Up to 40 feet thick across much of the Reservation.	Eolian dune and interdune environments.		
Jurassic	Wanakah Formation	Beclabito Member	An assemblage of interbedded reddish-orange to reddish-brown claystone, siltstone, silty sandstone, and fine-grained sandstone.	About 80 feet thick in the subsurface in the western part of the Reservation and thickens to about 100 feet in the central and eastern parts.	Deposited in marginal-marine and sabkha environments.		

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Jurassic	Wanakah Formation	Todilto Limestone Member	Light-gray to dark-gray, thinly laminate to massive limestone.	As thick as 120 feet in the southeastern part of the Reservation and pinches out in the subsurface west of the Reservation. The unit is about 15 feet thick in the Piedra River area.	A large, restricted marine basin.		
Jurassic	Entrada Sandstone	Slick Rock Member	White, pinkish-orange, and reddish-orange, very fine to fine-grained to locally medium-grained sandstone.	Averages 70 to 100 feet thick and up to 250 feet to the north in the Piedra River area.	Eolian dunes and interdunes that bordered the Jurassic sea.	Under-ground water disposal	
Jurassic	Entrada Sandstone	Dewey Bridge Member	Very fine-grained argillaceous sandstone and siltstone.	About 25 to 35 feet thick in the western portion of the Reservation, pinches out to the east, and is not present in the Durango and Piedra River areas.	A sabkha environment that bordered the Jurassic sea, which was present to the north and west of Colorado.		
Jurassic	Glen Canyon Group	Navajo Sandstone	All three formations are composed mainly of sandstone in Colorado and are difficult to distinguish as separate units near the eastern punchout of the group.	From its eastern punchout, west of the town of Red Mesa the group thickens abruptly westward to about 500 feet at the Colorado-Utah state line.	Eolian unit.		
Jurassic	Glen Canyon Group	Keyenta Formation			Eolian unit.		

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Jurassic	Glen Canyon Group	Wingate Sandstone	Interbedded red to purplish-red, very fine- to coarse-grained sandstone, conglomerate, siltstone, and mudstone. Is equivalent to part of the Chinle Formation in other parts of the Four Corners region.	About 900 to 1,200 feet thick on the west side of the Reservation and is cut out in the Piedra River area by a pre-Entrada Sandstone unconformity.	Fluvial-channel, floodplain, lacustrine, and eolian sand-sheet deposits.		
Triassic	Dolores Formation		Tan, reddish-brown, orangish-red, very fine- to medium-grained sandstone. The sandstone is very thick bedded and exhibits large-scale, high-angle crossbeds.	Typically 250 feet thick in southwestern Colorado but ranges from 0 to 100 feet thick on the Reservation.	An eolian deposit.		
Permian	Cutler Group	De Chelley Sandstone	Interbedded reddish-brown to red siltstone, silty sandstone, and sandstone. Thin beds of limestone and siltstone-pebble conglomerate are present locally near the base in the area to the west of the Reservation.	Typically 500 to 900 feet thick.	Coastal-plain, mud-flat deposits in the southern part of the area and grades northward into fluvial deposits.		

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Permian	Cutler Group	Organ Rock Formation	Sequence of pastel siltstone and shale with secondary amounts of gypsum, sandstone, and limestone. This sequence is distinctive in being pale red in contrast to the reddish-brown color of other parts of the Cutler above and below.	Ranges in thickness from 150 to 350 feet.	Tidal-flat and sabkha conditions.		
Permian	Cutler Group	Cedar Mesa Sandstone	Reddish-brown to dark-brown silty sandstone and siltstones and minor gray limestone. Thin beds of sandstone and siltstone are interbedded and outcrops consist of a series of slopes and ledges.	Averages between 350 and 800 feet.	Alternating beds of marginal-marine mud-flat and fluvial sediments that were deposited near sea levels.		
Pennsyl-vanian	Rico Formation		Conglomeratic sandstone and arkose interbedded with greenish-, reddish-, and brownish-gray shale and sandy fossiliferous limestone.	Averages about 200 feet.	A unit that was transitional between the underlying marine Hermosa Group and the overlying continental Cutler Group.		

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Pennsyl-vanian	Hermosa Group	Honaker Trail Formation	Light-gray to dark-gray, finely crystalline limestone and dolomite, micaceous siltstone, and arkosic sandstone. The percentage of limestone increases at the base of the unit and toward the center of the basin, and the formation includes more clastic rocks in the upper part of the unit and along the north basin margin.	Between 800 and 1,200 feet thick across much of the Reservation, although it thins abruptly to the east.	Open marine basin. The ancestral Uncompahgre highland that bounded the north side of the Paradox Basin was apparently increasingly active during deposition of the Honaker trail sediments as indicated by greater amounts of arkosic clastic rocks in the unit along the paleomountain front. The lobate distribution of these clastic rocks suggests deposition in fan deltas along the northeast margin of the Paradox Basin.		

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Pennsyl-vanian	Hermosa Group	Paradox Formation	Complex sedimentary rock unit in southwest Colorado. Divided into cyclic units (Baars and others 1967) (in ascending order), Alkali Gulch, Barker Creek, Akah, Desert Creek, and Ismay. These units are bounded by black shale beds; correlation from the evaporite facies to the shelf-carbonate facies is made possible by recognition of the shale marker beds.	Limiting recognition of the Paradox Formation to only the areas where salt or anhydrite occurs would place the eastern extent of the Paradox roughly halfway across the Reservation. However, rocks equivalent to the evaporite facies may be recognized in the eastern part of the Reservation and in areas to the south of the Reservation by correlation of shale marker and carbonate beds. Thickness of the Paradox Formation varies between 400 and 1,800 feet thick.	The sediments of the Paradox Formation and equivalent rocks were deposited in a subsiding elongate trough that was oriented northwest-southeast and bounded by uplifts. (The Paradox Basin underwent periodic episodes of rising and falling sea level making the cyclic deposits.)		Gas and oil

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit	Lithology	Thickness and Distribution	Depositional Environment	Use	
					San Juan Basin	Four Corners Platform
Mississippian	Leadville Limestone	Yellowish-brown and light to dark-gray, finely to coarsely crystalline, fossiliferous dolomite and limestone. Dolomite is more common than limestone in the lower, thin- to medium-bedded part of the unit, and limestone is the dominant lithology of the upper, more massively bedded part. The top of the Leadville, which was deeply eroded into karst topography before deposition of the overlying sediment, has joint and cavern fillings of reddish siltstone and mudstone. This residual material filtered downward after lithification of the Leadville and was not a primary deposition feature.	Thickness ranges from nearly 0 feet on the east side of the Reservation to about 250 feet on the west side.	The Leadville limestone of southwest Colorado and adjacent areas was formed during two transgressive episodes int he Mississippian. The sediment of the lower dolomitic part were deposited under shallow-water tidal-flat conditions and that those of the upper part were deposited in diverse marine environments, which ranged from low-energy stable-shelf conditions to high-energy shoals (Condon 1992).		

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Devonian	Ouray Limestone		Dark-brown to light-gray, dense, argillaceous limestone with local green clay partings. The basal bed of the Ouray is a tan dolomite in many places. A green clay bed as thick as 15 feet commonly occurs at the top. Abundant brachiopods, gastropods, crinoids, and toraminiferans.	Generally thickens from a punchout near the east side of the Reservation to 100 feet near the Utah-Colorado state line.	The marine fauna and widespread extent of the Ouray indicate deposition in a shallow sea on a cratonic shelf between the Cordilleran miogeocline to the east and the North American craton to the west. The sediments of the Ouray were deposited during the last major transgression of the Late Devonian sea.		
Devonian	Elbert Formation	Upper Member	Poorly exposed, thinly bedded, brownish-gray, sandy dolomite, and sandstone; green to red shale; and minor anhydrite.	The Upper Member ranges from 150 to 250 feet in thickness in areas to the west of the Reservation and thins eastward to about 25 feet in the Piedra River area. The unit is not recognized east of Chromo, Colorado.	The presence of salt casts, stromatolites, and fish remains suggests that sediments of the Upper Member were deposited in the shallow-water tidal-flat environment. Sediments of the Upper Member of the Elbert Formation were deposited in the gradually deepening waters of a Late Dovonian marine transgression.		

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit		Lithology	Thickness and Distribution	Depositional Environment	Use	
						San Juan Basin	Four Corners Platform
Devonian	Elbert Formation	McCrack-en Sandstone Member	Gray to brown sandstone, brown and gray dolomite, and greenish-gray shale. The dominant lithology is very fine- to coarse-grained sandstone. The lithology changes areally depending on the lithology of the source. The sandstone is thin to thick bedding with small- to medium-scale crossbeds. The sandstone is highly silicified and weathers to ledgy cliffs. Although the McCracken and Ignacio Quartzite are somewhat different mineralogically, they look similar in outcrops, leading to misidentifications and miscorrelations (Condon 1992).	Ranges from 0 to 140 feet in the subsurface. Baars (1966) reported that the McCracken is best developed on the flanks of Paleozoic fault blocks but is absent over the tops of several blocks. The McCracken Sandstone appears to be absent in most of the San Juan Basin; however, distribution is poorly constrained on the Reservation due to lack of deep drilling.	The McCracken is composed of shallow-marine, nearshore sediment that were deposited during a eustatic sea-level rise in the Late Devonian. Authors have interpreted the McCracken and other Elbert sandstones as shallow-shelf assemblages of barrier bar, wave break-point bar, and blanket sand deposits (Condon 1992). Lack of cobbles or boulders near the Paleozoic fault blocks has led Baars and See (1968) to the conclusion that the faults were not active during deposition of the McCracken.		

TABLE H-1
Generalized Stratigraphic Column of the Southern Ute Indian Reservation

Age	Rock Unit	Lithology	Thickness and Distribution	Depositional Environment	Use	
					San Juan Basin	Four Corners Platform
Cambrian	Ignacio Quartzite	White, reddish-brown, and light-brown conglomerate; feldspathic and quartzose very coarse to fine grained sandstone; purple to green, burrowed, micaceous mudstone and siltstone; and minor dolomite. The sandstone commonly contains angular clasts of potassium feldspar. Upper part of the Ignacio, which consists of fine grained clastic rocks and dolomite.	Averages 150 feet in the northwest part of the Reservation and thins to about 30 feet in the Piedra River Canyon about 20 miles west of Pagosa Springs. In some places, such as north of Durango, the Ignacio is absent due to onlap onto Proterozoic rocks. The Ignacio is not recognized on the east side of the Reservation but thickens markedly to the west and northwest. Selectively eroded or preserved on northwest-trending horsts and grabens.	In streams and on alluvial fans. The conglomerate in the formation was apparently derived from nearby uplifted Proterozoic fault blocks and, in some cases, consists of angular boulders that were not transported far. There is a shallow-shelf assemblage of material that was deposited by the eastward transgressing sea of the Cordilleran miogeocline.		
Precambrian	Precambrian Rocks	Gneiss, schist, amphibolites, granite, gabbro, and metaconglomerate.	The distribution of these different rock types beneath the Reservation is unknown.			

Descriptions from Aubrey 1991 and Condon 1992.

APPENDIX I
FORMATION AND PRODUCTION OF COALBED METHANE

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FORMATION AND PRODUCTION OF COALBED METHANE

FORMATION OF COALBED METHANE

Coalbed methane (CBM) is formed during coalification, or the formation of coal. The process of coalification encompasses physical and chemical changes that occur in coal, beginning shortly after deposition, continuing throughout the burial history. During coalification, natural gases are generated from organic matter through biogenic (peat), early thermogenic (subbituminous to bituminous), and late thermogenic (bituminous-anthracite) processes. Although methane is the major gas component in coalbed gases, water, carbon dioxide, wet gases (ethane, propane, butane, etc.), nitrogen, and liquid hydrocarbons are also generated. In general, gases produced from lower rank coals (peat; vitrinite reflectance values less than 0.5 percent) are biogenic. Biogenic methane is produced at relatively low temperatures through the metabolic activity of bacteria. Primary biogenic methane generated during early coalification (peatification) is probably not retained by the coal in large quantities, suggesting that most of the biogenic gases found in coalbeds are actually secondary biogenic gases related to meteoric recharge and basin hydrodynamics. In contrast, gases produced from higher rank coals are predominantly thermogenic. Early thermogenic gases are formed before and during the main stage of liquid hydrocarbon generation (often referred to as the oil window). Once the threshold of thermogenic methane generation is attained, between vitrinite reflectance values of 0.8 and 1.0 percent, significant quantities of methane can be generated from coalbeds. Carbon dioxide is also released from the coal structure during coalification and/or is generated through the metabolic activity of bacteria during primary or secondary bacterial gas generation. Wet gases are generated from hydrogen-rich coals during coalification, and Scott (1994) reports that ethane is sorbed on some Fruitland coals, typically in the southern portion of the San Juan Basin. Nitrogen is also released during coalification from bacterial metabolism and/or occurs during thermal maturation of the coal. Dry thermogenic gases are formed by late thermogenic processes and/or by cracking heavier hydrocarbons formed from hydrogen-rich coals (Scott 1994).

Gases in the Fruitland Formation are mainly thermogenic in origin. The regional distribution of the coalbed gases suggests that coal rank is not the only factor controlling the chemical composition of the gas. There is significant difference in the coalbed gas composition between the overpressured (artesian hydraulically confined) and underpressured (non-flowing hydraulically confined) parts of the Fruitland Formation in the basin. The overpressured coalbed gases, located in the north-central part of the San Juan Basin and within the Study Area, are chemically drier (contain little or no ethane, propane, etc.) than the underpressured coalbed gases. High concentrations of carbon dioxide are associated with the overpressured coalbed gases. Nitrogen content of the Fruitland coalbed gases is generally low and does not appear to vary with the hydrogeologic regime of the formation. The gas composition correlates better with the pressure regime in the Fruitland Formation than with coal rank, suggesting that basin hydrology is a major factor controlling coalbed gas composition (Scott 1994).

COALBED METHANE PRODUCTION

The nature of the gas within the coalbed and the process used to release the gas is unique to CBM production. A coal seam is a dual porosity medium that consists of a solid matrix containing micropores and a natural fracture system known as cleats. Prior to production of a reservoir, water saturates the cleat system. This water may or may not contain free or dissolved gas but generally no free gas exists within the cleat system. The methane, rather, is adsorbed on the surface of the coal in the walls of the micropores (Ely et al. 1988). When the water from the cleat system is produced, the reservoir pressure within the coal bed decreases and the sorption capacity (the ability of the coal to retain gas) of the coal also decreases. As a result, the methane and other gases (primarily carbon dioxide, but ethane and propane also may be present) desorb and subsequently migrate from the micropore walls into the cleat system. The desorbed gas will migrate through the cleat system to lower pressures (Scott 1994).

Since water must be produced to lower the pressure and subsequently release the methane, large quantities of "produced" water are typically associated with CBM production. Fruitland CBM wells can produce more than 1,000 barrels of water per day (BWPD), although they average much less. For example, in 1998, Ignacio Blanco Fruitland wells averaged 64 barrels of water per day (Dwight's 2000). Water production also will typically decrease over the life of a well, while gas production will typically increase to a peak over a period of years and then decline similar to the way production from a conventional well declines.

As discussed in Section 3.5.1, the Fruitland coalbeds were initially under overpressured conditions in the central basin extending to within 2 miles of the northern portion of the outcrop (Ayers 1988). The artesian (or flowing) hydraulically confined condition of the aquifer is referred to as an overpressured reservoir. The overpressured nature is beneficial for well development because operators can use the higher pressure to complete the well naturally rather than introduce into the formation other materials such as fracture stimulation fluids, which have a tendency to cause formation damage and reduce reservoir permeability.

The confined nature of the Fruitland water provides the drive mechanism to bring the water to and into the well bore. For example, a confined aquifer is considered to be artesian when the water flows to the surface. During initial Fruitland CBM development, most of the CBM wells were artesian or overpressured, and the formation pressure and surface pumps were and are used to reduce the total pressure of the coals. Depleting the pressure, by pumping the water as discussed above, allows the methane to desorb from the coal. This drive mechanism is not very effective since less than 50 percent of the gas-in-place will be produced. There is a practical and economic limit to the extent to which reservoir pressure can be reduced. Studies have found that the methane desorption from the coal is achieved by reducing the partial pressure of the methane rather than merely the total pressure of the formation; thus, enhanced recovery production techniques are being evaluated for the Fruitland and other CBM fields (Puri and Yee 1990).

The Fruitland Formation water is predominately sodium bicarbonate (see Section 3.5.1 for a description of the groundwater associated with the Fruitland Formation). The produced water is typically disposed, or reinjected, into a deeper formation because of its high total dissolved solids (TDS) concentrations. Within the Study Area approximately 30 disposal wells are permitted for injecting produced water into deeper formations, typically the Entrada or Bluff (Junction Creek) sandstones. The formations used for water disposal must meet the following criteria:

- The aquifer does not currently serve as a source of drinking water.

- The aquifer currently cannot and will not in the future serve as a source of drinking water because it is:

  - mineral, hydrocarbon, or geothermal energy producing or can be demonstrated to contain minerals or hydrocarbons that, considering their quantity and location, are expected to be commercially producible;

  - situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical; or

  - contaminated to an extent that it would be economically or technologically impractical to render the water fit for human consumption.

- The TDS content of the groundwater is more that 3,000 milligrams per liter (mg/L) but less than 10,000 mg/L, and it is not reasonably expected to supply a public water system.

Played-out conventional wells (wells that are no longer economical to produce) also can be converted and permitted for disposal if properly completed. Within the boundaries of the Reservation, the Environmental Protection Agency (EPA) has permitting authority over the produced water disposal wells for the underground injection control (UIC) program. On fee land, EPA's permitting and regulation of disposal wells is duplicated by the Colorado Oil and Gas Conservation Commission (Zimpler et al. 1988; Southern Ute Indian Tribe Environmental Programs and Energy Resources 1996).

The Fruitland Formation water is predominantly sodium bicarbonate (see Section 3.6.1 for a description of the groundwater associated with the Fruitland Formation). The produced water is typically disposed of by reinjection into a deeper formation because of its high total dissolved solids (TDS) concentrations. Within the Study Area approximately 38 disposal wells are permitted for injecting produced water into deeper formations, typically the Entrada or Bluff (Junction Creek) sandstones. The formations used for water disposal must meet the following criteria:

a. The aquifer does not currently serve as a source of drinking water;

b. The aquifer currently cannot and will not in the future serve as a source of drinking water because it is:

- mineral, hydrocarbon, or geothermal energy producing or can be demonstrated to contain minerals or hydrocarbons that, considering their quantity and location, are expected to be commercially producible;
- situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical; or
- contaminated to an extent that it would be economically or technologically impractical to render the water fit for human consumption.

c. The TDS content of the groundwater is more than 3,000 milligrams per liter (mg/L) but less than 10,000 mg/L and it is not reasonably expected to supply a public water system.

Played-out conventional wells (wells that are no longer economical to produce) also can be converted and permitted for disposal if properly completed. Within the boundaries of the Reservation, the Environmental Protection Agency (EPA) has permitting authority over the produced water disposal wells for the underground injection control (UIC) program. Off the land, EPA's permitting and regulation of disposal wells is duplicated by the Colorado Oil and Gas Conservation Commission (Zimpfer et al. 1988; Southern Ute Indian Tribe Environmental Programs and Energy Resources 1996).

APPENDIX J
SOIL CHARACTERISTICS OF THE SUIT STUDY AREA

APPENDIX J
SOIL CHARACTERISTICS OF THE STUDY AREA

SOIL LEGEND

Map Unit[1]	BIA Symbol	Map Unit Name	Texture	Slope (%)	Erosion Potential		Soil pH	Shrink-Swell Potential	Risk of Corrosion		Prime Farmland
					Water	Wind			Uncoated Steel	Concrete	
1	T2-B	Agua Fria loam	loam, clay loam, very stony to very cobbly loam	1 to 3	slight	slight	7.4-8.4	low to moderate	high	low	yes
4	T4-B	Arboles silty clay loam	silty clay loam, silty clay	0 to 3	moderate	moderate	6.6-8.4	high	high	low	-
5	E0-CD T4-C	Arboles clay	clay, silty clay	3 to 12	moderate	moderate	6.6-8.4	high	moderate	low	yes
6	C5F C5-F	Archuleta loam	loam, clay loam	12 to 65	moderate	very slight	6.1-7.8	moderate	moderate	low	-
7	XC5-F	Archuleta-Sanchez complex	clay loam, stony sandy clay loam	12 to 65	moderate	very slight	6.1-7.8	low to moderate	high	low	-
8	S0-CD	Baca Variant loam	loam, silty clay loam	3 to 12	moderate	slight	6.6-8.4	low to high	high	low	yes
9	BD	Badland			high to severe	high to severe	-	-	-	-	-
10	A6-B	Bayfield silty clay loam	silty clay loam, silty clay	1 to 3	high	slight	6.6-8.4	moderate to high	high	low	yes
11	A6-B3	Bayfield clay loam, gullied	silty clay loam, silty clay	1 to 3	high; subject to severe gully erosion	slight	6.6-8.4	moderate to high	high	low	-
12	A6W-B	Bayfield silty clay loam, seeped	silty clay loam, silty clay	1 to 3	slight	slight	6.6-8.4	moderate to high	high	low	yes

SOIL LEGEND

13	V4-CD	Big Blue clay loam	clay loam, silty clay	0 to 6	slight	slight	7.9-8.4	moderate to high	high	low	-
14	E8-CD	Bodot clay	clay, clay loam	3 to 10	high	moderate	7.4-9.0	high	high	moderate	-
16	A5-B	Buckle loam	loam, clay loam	1 to 6	moderate	very slight	7.9-8.4	low to moderate	high	low	yes
17	H4-E	Chris very stony loam	very stony loam, gravelly clay loam	9 to 25	moderate	none	5.6-6.5	low to moderate	moderate	moderate	-
19	V5-CD	Clayburn loam	loam, clay loam	3 to 12	slight	slight	6.1-7.3	low to moderate	moderate	low	yes
21	M3-D	Coni loam	loam, clay loam	4 to 25	moderate	slight	6.1-7.3	low to moderate	moderate	low	-
22	C0-B	Corta loam	loam, clay, silty clay	1 to 3	moderate	slight	6.1-7.8	low to high	moderate	low	yes
23	CO-C	Corta loam	loam, clay, silty clay	3 to 8	moderate	slight	6.1-7.8	low to high	moderate	low	yes
24	XM9E	Dulce-Travessila-Rock outcrop complex	sandy loam	6 to 50	moderate	high	6.6-8.4	low	moderate	low	-
25	R6A-C	Durango cobbly loam	cobbly loam, clay loam	3 to 20	slight	none	6.6-9.0	low to high	high	low	-
26	R8-B	Falfa clay loam	clay loam, silty clay	1 to 3	moderate	moderate	6.6-8.4	moderate to high	high	low	yes
27	R8-CD	Falfa clay loam	clay loam, silty clay	3 to 8	moderate	moderate	6.6-8.4	moderate to high	high	low	yes
28	A2W-A	Fluvaquents	sand to very gravelly sand	0 to 3	slight, frequently flooded	high	6.6-7.8	low	moderate	low	-
31	R5-EF	Goldvale very stony fine sandy loam	very stony fine sandy loam, strong sandy clay	15 to 65	slight	none	6.1-7.3	low to moderate	moderate	moderate	-
32	RCL	Haploborolls-Rubble Land complex	very cobbly loam, very stony clay loam	10 to 60	moderate	none	6.1-7.8	low	moderate	low	-
33	T1-B	Harlan cobbly loam	cobbly loam, clay loam	1 to 3	slight	none	6.6-8.4	low to moderate	moderate	low	-
34	T1-D	Harlan cobbly loam, most	cobbly loam, clay loam	3 to 15	moderate	none	6.6-8.4	low to moderate	high	low	-
36		Hayness loam	loan, clay loam, silt loam	3 to 12	moderate	slight	7.4-9.0	low	high	low	yes

SOIL LEGEND

37	C2E	Herm loam	loam, clay loam	6 to 25	slight	slight	6.1-7.8	low to high	moderate	low	-
39	V2-CD	Hesperus loam	loam, clay loam	3 to 12	slight	slight	6.1-7.8	low	moderate	low	yes
41	MO-DE	Lazear stony loam	stony loam	6 to 25	moderate	none	7.4-9.0	low	high	low	-
42	XMO-F	Lazear-Rock outcrop complex	very stony loam, stony loam	12 to 65	moderate	none	7.4-9.0	low	high	low	-
43	D2-EF	Leadville very stony sandy loam	very stony sandy loam, very stony clay loam	15 to 55	slight	none	5.6-7.0	low to moderate	moderate	moderate	-
44	V0-CD	Mikim loam	loam, clay loam	3 to 12	high	slight	6.6-08.4	low	high	low	yes
45	T3-BC	Nehar stony sandy loam	stony sandy loam, stony clay loam	1 to 6	slight	nopne	6.1-7.8	low to moderate	moderate	low	-
47	A3-B	Nutrioso loam	loam, fine sandy loam to clay loam	1 to 3	moderate	very slight	6.6-7.8	low	high	low	yes
48	A7-C	Panbitchen-Dominquez varient silty clay loams	silty clay loam, silty clay	1 to 6	high	moderate	7.9-9.0	moderate	high	low to high	-
49	T6-B	Pastorius cobbly loam	cobbly loam, very cobbly clay loam	1 to 3	slight	none	6.1-7.8	low to moderate	moderate	low	-
50	A2-AB	Pescar fine sandy loam	fine sandy loam, loamy fine sand	0 to 2	slight; subject to frequent flooding	high	6.6-8.4	low	high	low	-
51	C6-E	Picante-Rock outcrop complex	clay loam, silty clay loam	10 to 45	high	moderate	7.4-8.4	moderate	high	low	-
52	D1-CD	Pinata loam	loam, clay loam, gravelly clay	1 to 12	slight	slight	6.1-7./8	low to high	moderate	low	-

SOIL LEGEND

53	D1-E	Pinata loam	loam, clay loam, very cobbly clay	12 to 40	moderate	slight	6.1-7.8	low to high	moderate	low	-
54	GP	Pits, gravel	-	-	-	-	-	-	-	-	-
55	R1-CD	Plome fine sandy loam	fine sandy loam, sandy clay loam	3 to 12	moderate	high	6.1-7.3	low to moderate	moderate	low	yes
56	M5-CD	Pulpit loam	loam, clay loam	3 to 12	moderate	slight	6.6-8.4	low to moderate	high	low	-
57	RV	Riverwash	sands, gravels, cobbles	-	-	-	-	-	-	-	-
58		Rock outcrop		15 to 90	-	-	-	-	-	-	-
59	TO-B	Sedillo gravelly loam	gravelly loam, very cobbly loam	0 to 3	slight	very slight	7.4-9.0	low	high	low	-
60	T5-B	Shalona loam	loam, clay loam, silty clay	1 to 6	slight	moderate	6.6-8.4	low to moderate	high	low	yes
62	V7-B	Sili clay loam	clay loam, silty clay loam	1 to 3	moderate	moderate	6.6-8.4	moderate to high	high	low	yes
63	V7-C	Sili clay loam	clay loam, silty clay loam	3 to 6	moderate	moderate	6.6-8.4	moderate to high	high	low	yes
64	V8-B	Simpatico loam	loam, silty clay loam, very cobbly loam	1 to 3	slight	slight	6.6-8.4	low to moderate	moderate	low	yes
65	J1-B	Sycle fine sandy loam	fine sandy loam, sandy clay loam	1 to 3	slight	very slight	7.4-9.0	low to moderate	high	low	yes
66	A0-B	Tefton loam	loam, clay loam to fine sandy loam	1 to 3	moderate	slight	7.4-8.4	low	moderate	low	yes
68	M8-F	Uinta loam	loam, gravelly sandy clay loam	15 to 60	moderate	high	6.1-7.8	low to moderate	moderate	low	-
69	VB-C	Umbarg loam	loam, clay loam	3 to 6	slight	moderate	7.4-8.4	low to moderate	high	low	yes
70	XTQ-E	Ustic Torriothents-Ustollic Haplargids complex	very gravelly loam, gravelly loam, very gravelly sand loam	12 to 60	high	slight	7.4-8.4	low	moderate	low	-

SOIL LEGEND

71	XM1-E	Valto Rock outcrop complex	very stony fine sandy loam very stony sandy loam	12 to 65	slight	none	6.1-7.3	low	moderate	low	-
72	T7-B	Vernal fine sandy loam	fine sandy loam, clay loam	1 to 3	slight	slight	7.4-8.4	low to moderate	high	low	yes
73	T-7C	Vernal-Sedillo complex	fine sandy loam, gravelly loam, gravelly to cobbly loam	3 to 12	slight	slight	7.4-9.0	low to moderate	high	low	-
74	V3-CD	Vosburg fine sandy loam	fine sandy loam, sandy clay loam	3 to 8	moderate	high	6.1-8.4	low	high	low	yes
75	R^-B R0-B	Witt loam	loam, clay loam, silty clay loam	1 to 3	moderate	slight	6.6-8.4	low to moderate	high	low	yes
76	R6-CD R0-CD	Witt loam	loam, clay loam, silty clay loam	3 to 8	moderate	slight	6.6-8.4	low to moderate	high	low	-
77	R2-CD	Witt loam, eroded	loam, clay loam, silty clay loam	3 to 12	moderate	slight	6.6-8.4	low to moderate	high	low	-
78	V0-B	Yenlo-Florita sandy loams	sandy loam, sandy clay loam	1 to 6	moderate	high	6.6-7./8	low	moderate to high	low	-
80	Ms-E	Zau stony loam	stony loam, clay loam, sandy clay loam	9 to 25	moderate	slight	6.1-7.8	low to moderate	moderate	low	-
81	E6-CE	Zyme clay loam	clay loam, clay, silty clay loam	3 to 25	high	moderate	7.4-8.4	high	high	low	-
82	XE-6-E	Zyme-Rock outcrop complex	clay loam, silty clay loam	12 to 65	high	moderate	7.4-8.4	high	high	low	-

[1]Soils Map 13, Map volume

APPENDIX K
CULTURAL RESOURCES - CULTURAL HISTORY, SENSITIVITY, MODELING, IMPACT ASSESSMENT STRATEGY

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APPENDIX K
CULTURAL RESOURCES - CULTURAL HISTORY, SENSITIVITY, MODELING, IMPACT ASSESSMENT STRATEGY

This appendix provides technical details about the cultural resources component of the EIS analyses. The appendix begins with a brief summary of regulatory requirements related to protection of cultural resources. Available cultural resource inventory data are then characterized, and the cultural history of the Southern Ute Indian Reservation (SUIR) and surrounding region is summarized to provide a context for evaluating the significance of cultural resources within the project area. This summary is based on previous overviews, the compiled inventory data, and the prior local experience of the staff of Southwestern Archaeological Services, Inc. who participated in this study (Susan Barnett, Barry Hibbets, and Doug Loebig). Methods used to model cultural resource sensitivity within the project area are discussed and projections of prehistoric, ethnohistoric, and historic resource sensitivity zones are described. The appendix concludes with a description of how these sensitivity projections were used to evaluate the potential impacts of the project and compare alternatives.

REGULATORY REQUIREMENTS

The National Environmental Policy Act (Section 101[b][4]) establishes a Federal policy of conserving the historic and cultural, as well as the natural, aspects of our national heritage as Federal agencies permit, fund, or plan and construct projects. The Council on Environmental Quality issued implementing regulations for *Protection of Environment* (40 CFR Part 1502.16[g]), stipulating that the consequences of Federal undertakings on historic and cultural resources be analyzed. In accordance with these and other Federal historic preservation regulations, cultural resources are considered in this environmental impact statement (EIS).

The Antiquities Act of 1906, the National Historic Preservation Act of 1966, as subsequently amended, and the Archaeological Resources Protection Act of 1979 are other Federal laws that protect cultural resources. In addition, the American Indian Religious Freedom Act of 1978 requires that all Federal agencies take into account the effects of their actions on traditional Native American religious and cultural values and practices. Also, the Native American Graves Protection and Repatriation Act of 1990 expressly provides for the protection of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony, and gives affiliated Native American groups priority in the treatment of such human remains and artifacts.

Regulations for *Protection of Historic Properties* (36 CFR Part 800), which primarily implement Section 106 of the National Historic Preservation Act, define key regulatory requirements beyond those of the National Environmental Policy Act. These regulations define a process for consulting with State Historic Preservation Officers, the Federal Advisory Council on Historic Preservation, and other interested parties to ensure that significant historic properties are duly considered as

Federal projects are planned and implemented. The steps in the "Section 106 consultation" process involve:

1. determining the potential area of effect

2. identifying and evaluating the significance of properties that may be affected by a proposed undertaking

3. assessing the potential effects of the undertaking on historic properties (that is, properties included in or determined eligible for inclusion in the National Register)

4. consulting with the State Historic Preservation Office, the Federal Advisory Council on Historic Preservation, and other appropriate interested parties to determine ways to avoid or reduce any adverse effects

5. providing the Advisory Council a reasonable opportunity to comment on the proposed undertaking and effects on historic properties

6. proceeding with the undertaking under the terms of a memorandum of agreement or in consideration of comments from the Advisory Council

Cultural resources include prehistoric, historic, and traditional cultural sites, buildings, structures, districts, and objects, as well as associated artifacts, records, and remains related to such properties. The significance of cultural resources is determined in consideration of the criteria for listing on the National Register of Historic Places. To be eligible for listing on the National Register, a property must be important in American history, architecture, archaeology, engineering, or culture and must possess integrity of location, design, setting, materials, workmanship, feeling, and association. In addition, properties must meet at least one of four criteria:

criterion A: association with events that have made a significant contribution to the broad patterns of our history

criterion B: association with lives of persons significant in our past

criterion C: embodiment of distinctive characteristics of a type, period, or method of construction, or representation of the work of a master, or possession of high artistic values, or representation of a significant distinguishable entity whose components may lack individual distinction

criterion D: have yielded, or may be likely to yield, information important in prehistory or history (36 CFR Part 60.4)

The eligibility of resources for listing on the National Register is seldom evaluated until they are threatened. Therefore, few of the cultural resources that have been inventoried within the project area have yet to be determined.

The Council on Environmental Quality regulations (§1502.25) encourage agencies to coordinate preparation of environmental assessments with other environmental review and consultation requirements, such as those of the National Historic Preservation Act. However, the proposed oil and gas leasing and development evaluated in this EIS is programmatic and specific impact zones are not identified at this time. Therefore, no formal Section 106 consultations were undertaken at this time.

INVENTORY METHODS

This EIS generically assesses alternative strategies for leasing and development of oil and gas reserves on SUIR. Site specific impacts are not addressed at this time, but will be considered by subsequent studies that "tier" off this generic evaluation. Inventory information compiled for the EIS was based on results of prior studies, and no new field surveys were conducted for the EIS.

Only about 46 percent of the lands within the external boundary of SUIR are Indian lands. This stems from the allotment of lands to individual Utes in the 1890s, subsequent opening of the unallotted "surplus" lands to homesteading by non-Indians, and then re-establishment of a Reservation in the 1930s. The situation is complicated because the surface ownership and subsurface mineral estates are sometimes split. As a result, there are multiple jurisdictions within the external boundary of SUIR, including Southern Ute Tribal lands held in trust by the Bureau of Indian Affairs (BIA), individual Indian allotments, Federal lands managed by the Bureau of Land Management (BLM) and the San Juan National Forest, plus many private landowners.

Because of the multiple jurisdictions, no one agency has compiled and maintains comprehensive cultural resource information for SUIR. The BIA Albuquerque Area Office has extensive files (several file cabinets) of reports of surveys on Southern Ute Tribal lands, but maintains no consolidated maps to track the extent of prior surveys or locations of recorded cultural resources. The files of the BLM and San Juan National Forest are limited and primarily relate to the relatively small amounts of land under their jurisdiction within the external boundary of SUIR. The Bureau of Reclamation also has file information for those lands that would be affected by the proposed Animas-La Plata project, but this also covers only limited parts of the project area.

The Southern Ute Tribe is working toward establishing its own cultural resource management program, but very little existing data are currently available in Ignacio. Some of the Tribal departments have copies of some surveys conducted under their auspices, but their files are far from complete and not organized to facilitate access.

A search of the computerized files maintained by the Colorado Historical Society revealed substantial data regarding prior surveys and previously recorded archaeological and historical sites.

Because these files yielded the most extensive and most readily available information, these data were used as the primary basis for the EIS analyses. The computerized files were supplemented by review of historic maps and records to identify named places and cultural features such as communities, ditches, roads, railroads, cemeteries, as well as other named natural features that sometimes give an indication of associated activities (such as Sawmill, High Flume, Pump, Cemetery, and Cannibal canyons; Tunnel Hill; Bridge Timber Mountain; and Mormon Reservoir). General Land Office records, including township plats and master title plats, proved to be particularly valuable. Previously compiled cultural resource histories and overviews of southwestern Colorado also were reviewed.

CHARACTERISTICS OF THE COLORADO HISTORICAL SOCIETY DATABASE

In May 1996, the Colorado Historical Society provided computerized database information for 40 townships that encompass the external boundary of SUIR (Townships 32 North, Ranges 1 through 13 West (including 1½ West), Townships 33 North, Ranges 1½ through 13 West, and Townships 32 North, Ranges 1½ through 13 West, all of the New Mexico Base Line and Meridian). The 34 North townships are atypical because they include two distinct section numbering series—one for those areas north of SUIR and the other for those within SUIR. The sections north of SUIR are numbered conventionally, but a new series begins again at Section 1 within SUIR. The letter "U" is added to those sections that overlap with numbered sections north of the Reservation. We did not consider information for those areas in Townships 34 North that were north of the SUIR boundary.

The Colorado Historical Society provided two computerized data files. One file documenting prior surveys has 17 potential fields of information (Table 1), and the other file has 32 fields for coding data about previously recorded sites (Table 2). A unique number assigned to each survey report provides a common link between the site file (field = site.doc.id) and survey file (field = id).

The information in the Colorado Historical Society files has some limitations. The data have been compiled over a number of years by a variety of researchers, and incorporate some inconsistencies and errors. In addition, information is incomplete for many of the prior surveys and recorded sites, and some surveys and recorded sites have not been incorporated into the files at all. Unfortunately, the spatial aspects of the prior surveys and recorded sites are not available in a geographical information system format.

TABLE 1
DATA FIELDS IN COLORADO HISTORICAL SOCIETY COMPUTERIZED SURVEY FILES

Field Name	Type of Information
id	unique survey number; first two letters are county code; next two letters are lead agency code; final R and NR numbers are sequential, with R (results) series indicating sites were recorded, and NR (negative results) series indicating no sites were found
name	name of the survey
procedure	indicates whether survey encompassed a "block" or linear transect, or both
county	county in which survey was conducted
lead agency	lead agency for the survey
institution	organization that performed the survey
doc.author	author of survey report
doc.name	label of report associated with the survey; usually same as NAME
method	type of survey; class I = literature review and records check; class II = sample field survey; class III = intensive field survey
completion.date	last day of survey fieldwork
acres.total	number of acres surveyed
site.count	number of sites recorded
if.count	number of isolated finds recorded
maps	U.S. Geological Survey quadrangle on which survey area is located
pmtrsq	legal location of survey, including prime meridian, township, range, section, and quarter-sections
zone.meters	universal transverse mercator (UTM) zone and easting coordinate
meters.north	UTM northing coordinate

TABLE 2
DATA FIELDS IN COLORADO HISTORICAL SOCIETY COMPUTERIZED SITE FILES

Field Name	Type of Information
id	site number (in Smithsonian Institution trinomial format)
site.name	name of site

TABLE 2
DATA FIELDS IN COLORADO HISTORICAL SOCIETY COMPUTERIZED SITE FILES

Field Name	Type of Information
resource.type	type of resource, as defined for National Register of Historic Places
address	address of property
assessment	eligibility for listing on the National Register of Historic Places
assessment.date	date of National Register eligibility assessment
organization	organization that recorded the site
recording.date	date site was recorded
condition	integrity of site, including whether it has been tested, excavated, or vandalized
date	date of condition characterization
site.doc.id	identification number of report in which site is referenced
site.doc	name of report in which site is referenced
argy.site.type	type of archaeological site
argy.culture	culture represented by archaeological site
argy.feature	types of features identified on archaeological site
argy.feature.cou	numbers of each type of feature found on archaeological site
argy.artifact	types of artifacts found on archaeological site
artifact.count	counts of each type of artifact found on archaeological site
arct.site.type	type of architectural (historical) resource
arct.style	architectural style of property
arct.feature	features and unusual aspects of architectural properties
archit.architect	architect who designed architectural property
arct.integrity	condition of architectural property
arct.early.date	date of construction (or earliest construction date) of architectural property
arct.late.date	latest date architectural property could have been constructed
prime.meridian	primer meridian of legal description of site location
township	township of legal description of site location
range	range of legal description of site location
section	section of legal description of site location

TABLE 2 DATA FIELDS IN COLORADO HISTORICAL SOCIETY COMPUTERIZED SITE FILES	
Field Name	**Type of Information**
maps	U.S. Geological Survey quadrangle on which site is located
zone.meters.east	universal transverse mercator (UTM) zone and easting coordinate
meters.north	UTM northing coordinate

Prior Surveys

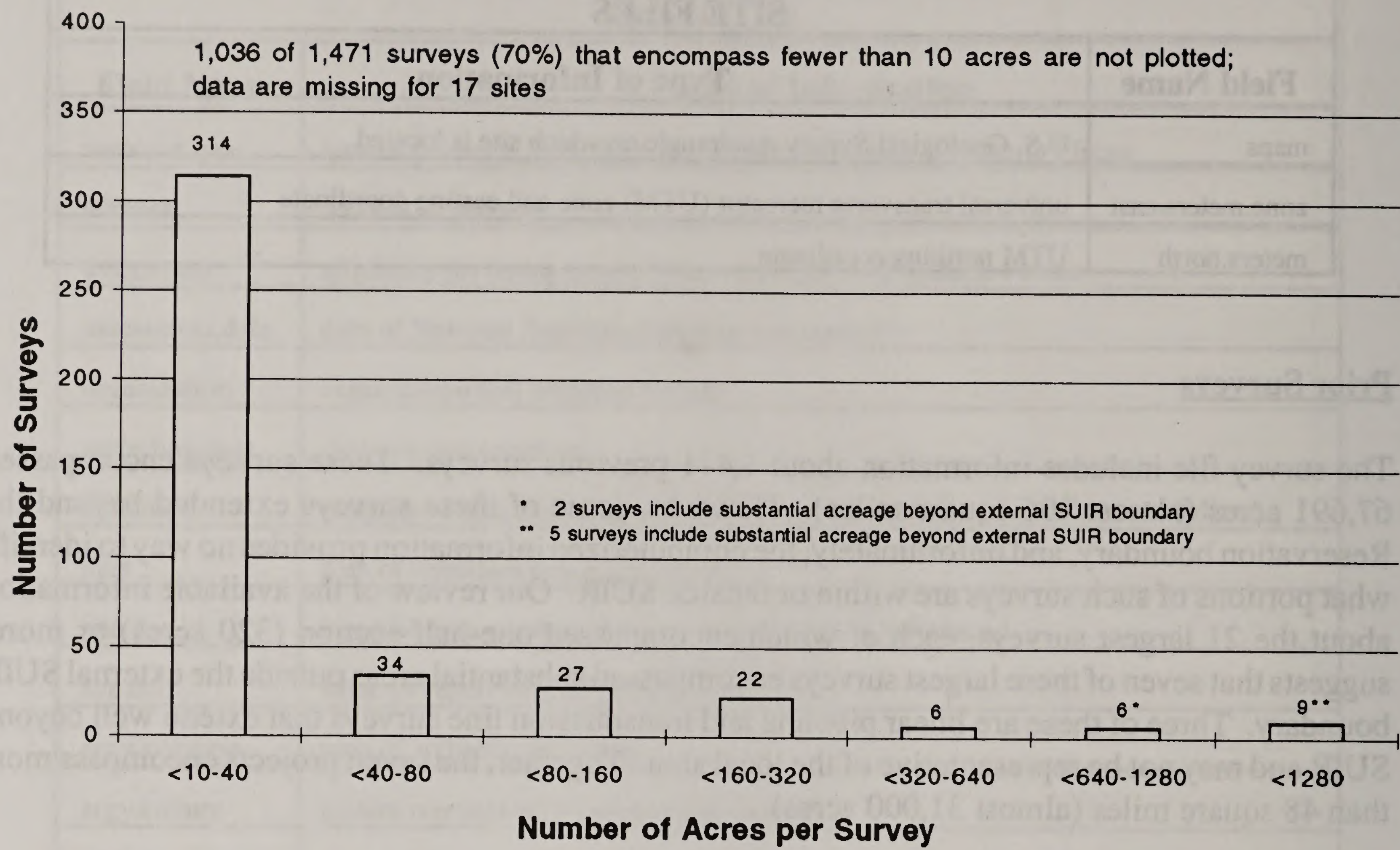
The survey file includes information about 1,471 previous surveys. These surveys encompassed 67,691 acres (almost 106 square miles). However, some of these surveys extended beyond the Reservation boundary, and unfortunately, the computerized information provides no way to identify what portions of such surveys are within or outside SUIR. Our review of the available information about the 21 largest surveys, each of which encompassed one-half section (320 acres) or more, suggests that seven of these largest surveys encompassed substantial areas outside the external SUIR boundary. Three of these are linear pipeline and transmission line surveys that extend well beyond SUIR and may not be representative of the local area. Together, the seven projects encompass more than 48 square miles (almost 31,000 acres).

The data field indicating the number of acres surveyed was not completed for 17 of the surveys, which also adds to the uncertainty of the extent of prior survey. Given these caveats, we estimate that something on the order of 55 to 60 square miles have been surveyed within the external boundary of SUIR, which constitutes something on the order of a 5 to 6 percent sample of the approximately 1,063 square miles within the external SUIR boundary.

The average area covered by each survey identified in the database is 46 acres. More than one thousand (or about 70 percent) of the prior surveys were quite small, covering 10 acres or less (Figure 1). Another 20 percent covered only 10 to 40 acres.

Assessment of prior surveys is complicated because the intensity of surveys varied, and the database does not identify specific measures of survey intensity, such as transect intervals walked by survey crews or the number of acres surveyed per person-day. Variations in these parameters certainly influence the number of archaeological sites identified within any area surveyed (Plog and others 1978). The computer files do indicate whether surveys were class III (total and "intensive," but without intensive being specified), or class II (sample surveys, but the sampling percentages are not identified, and it is not clear whether examined acres or sampled acres are reported).

Figure 1
Number of Acres per Survey



Source: Colorado Historical Society survey database

About 82 percent of the surveyed acreage is identified as class III, only about 7 percent as class II, and the remaining 11 percent as unspecified "other." A total of 1,399 sites are associated with the class III surveys for an average of about 17 sites per square mile. The 68 sites reported for the class II surveys yield a lower average of about 9 sites per square mile, suggesting that the acreage reported for at least some of the class II surveys probably is the entire area sampled, rather than just the acres that were walked within selected sample units.

The surveys also are classified as either block or linear surveys. In general, linear surveys can be expected to result in the discovery of relatively more sites than block surveys because of an "edge effect." This effect is more pronounced when the dimensions of sites are larger than the width of survey transects (Plog and others 1978). Roughly half the surveys are classified as block surveys, about a third as linear, and the other 20 percent incorporate both block and linear elements.

The database indicates the agencies for which surveys were conducted. Approximately two-thirds of the surveys were conducted under the auspices of the BIA, reflecting the Reservation status of much of the analysis area (Figure 2). However, the size of the surveys for the BIA were comparatively small and represent only about 20 percent of the surveyed acreage tabulated in the database (Figure 3). The other major Federal land managing agencies in the region—the San Juan National Forest and the BLM San Juan Resource Area—are identified as the sponsoring agencies for two to four percent of the surveys, but 10 to 13 percent of the surveyed acreage. A number of other agencies are identified as having jurisdiction for only one to six surveys. [Although the BLM Montrose District Office is identified as sponsoring 13 percent of the surveyed acreage, this was due to a single linear project, the Transcolorado Pipeline, and the vast majority of that acreage was beyond the SUIR boundary.] The sponsoring agencies are not identified for one-fourth of the surveys, which encompassed almost 40 percent of the surveyed acres.

More than 25 institutions have conducted the surveys tabulated in the database (Figure 4). A single firm—Archaeological Consultants, which was virtually the only consultant issued permits to work on Southern Ute Tribal lands for more than 15 years, conducted about 70 percent of these surveys. However, surveys by Archaeological Consultants were smaller than the average survey, and in the aggregate encompassed only about 28 percent of the surveyed acreage (Figure 5).

The annual rate of survey is depicted on Figure 6. Although archaeological research has been pursued within southwestern Colorado for more than a century, the database tabulations of surveys within SUIR date back only about 20 years. The average of about 70 surveys per year since 1975 was first exceeded in 1984. The number of surveys peaked in 1990, and undoubtedly reflects a flurry of activity related to deadlines for tax credits for oil and gas development at that time. The number of surveys conducted annually fell below the average in 1993 and continued to decrease through 1995.

The plot of the number of acres surveyed per year is much more erratic than the number of surveys (Figure 7). However, when the seven large surveys that seem to be mostly beyond the SUIR boundary are subtracted, the graph is much more similar to the number of surveys conducted annually. The average rate of survey since 1975 appears to be on the order of 1,400 to 1,500 acres

annually. Therefore, the peak of activity in 1990 represents about three times the average rate, which again is consistent with the number of surveys.

Previously Recorded Sites

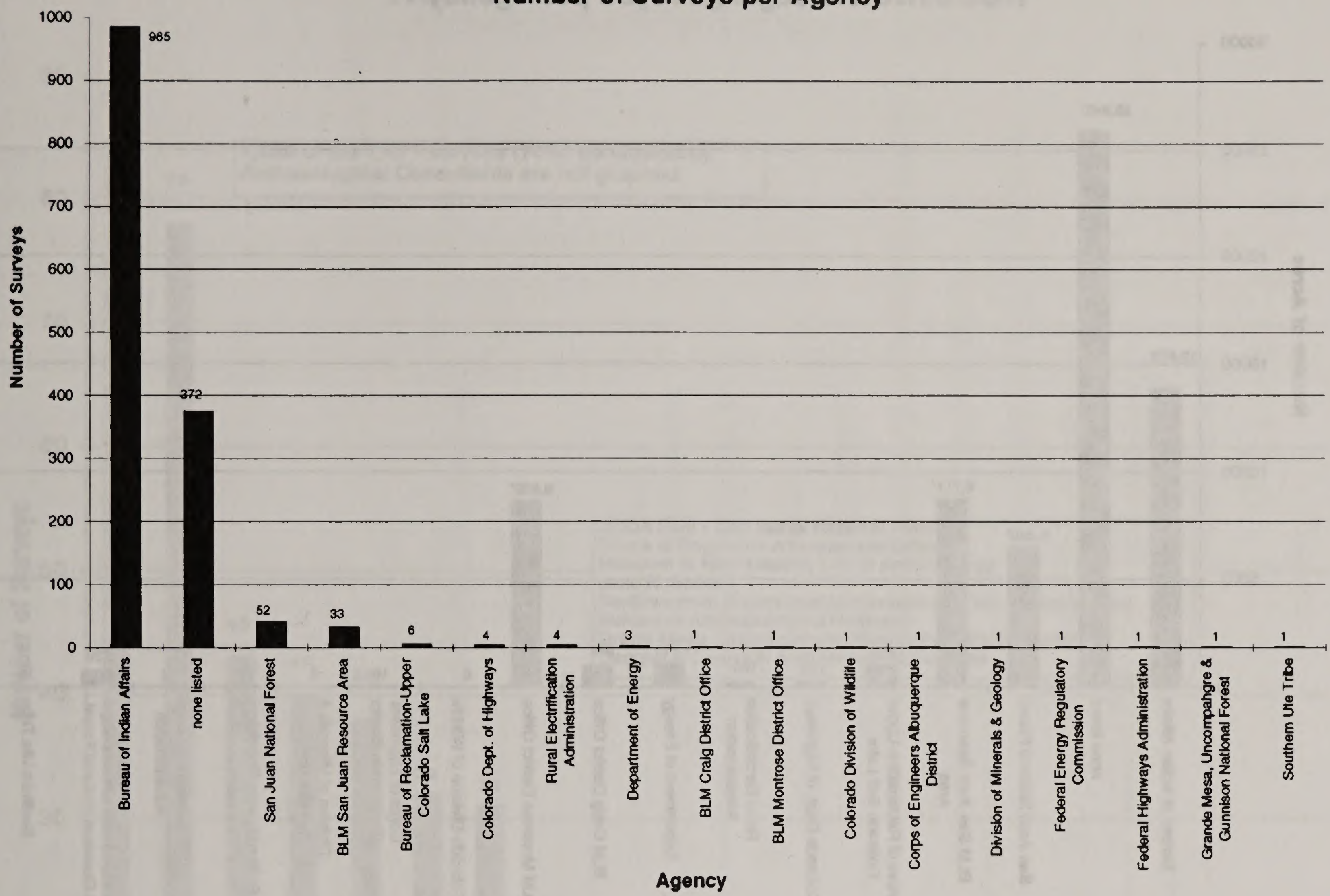
The survey database identifies 1,799 sites as having been recorded by 1,419 surveys for which data are available. That is an average of about 1.3 sites per survey. [Note that this average would be considerably less if the several surveys that reported many sites beyond the SUIR boundary were excluded.] The survey database indicates that 67,691 acres (almost 106 square miles) were inventoried to identify the 1,799 sites, which is an average of about 17 sites per square mile.

In a pattern consistent with the typically highly clustered nature of archaeological data, almost 80 percent of the surveys reported no sites, and only 25 surveys recorded 10 or more sites (Figure 8). Only a few of these 25 appear to have been related to oil and gas development [Cox Canyon gathering system (10 sites), Indian Creek gathering system (19 sites), Valencia Canyon gathering system (21 sites), Petty-Ray seismic lines (54 sites)].

An examination of the largest surveys provide some additional insight into the site densities (Table 3). Nine of the largest surveys have sufficient data to be classified as linear surveys encompassing an aggregate of almost 457 linear miles. These resulted in the discovery of 572 sites for an average of about 1.3 sites per linear mile. Densities ranged to more than 9 sites per linear mile, but the higher than average densities tend to be associated with short surveys, which could be subject to the considerable vagaries of small samples. Sufficient information is available for 11 of the largest surveys to classify them as primarily block surveys encompassing an aggregate of almost 33 square miles. A total of 359 sites were recorded by these 11 block surveys for an average of 11 sites per square mile. Site densities ranged almost to 60 sites per square mile but the higher than average densities again tend to be associated with the smaller surveys, although not as strongly as the linear surveys.

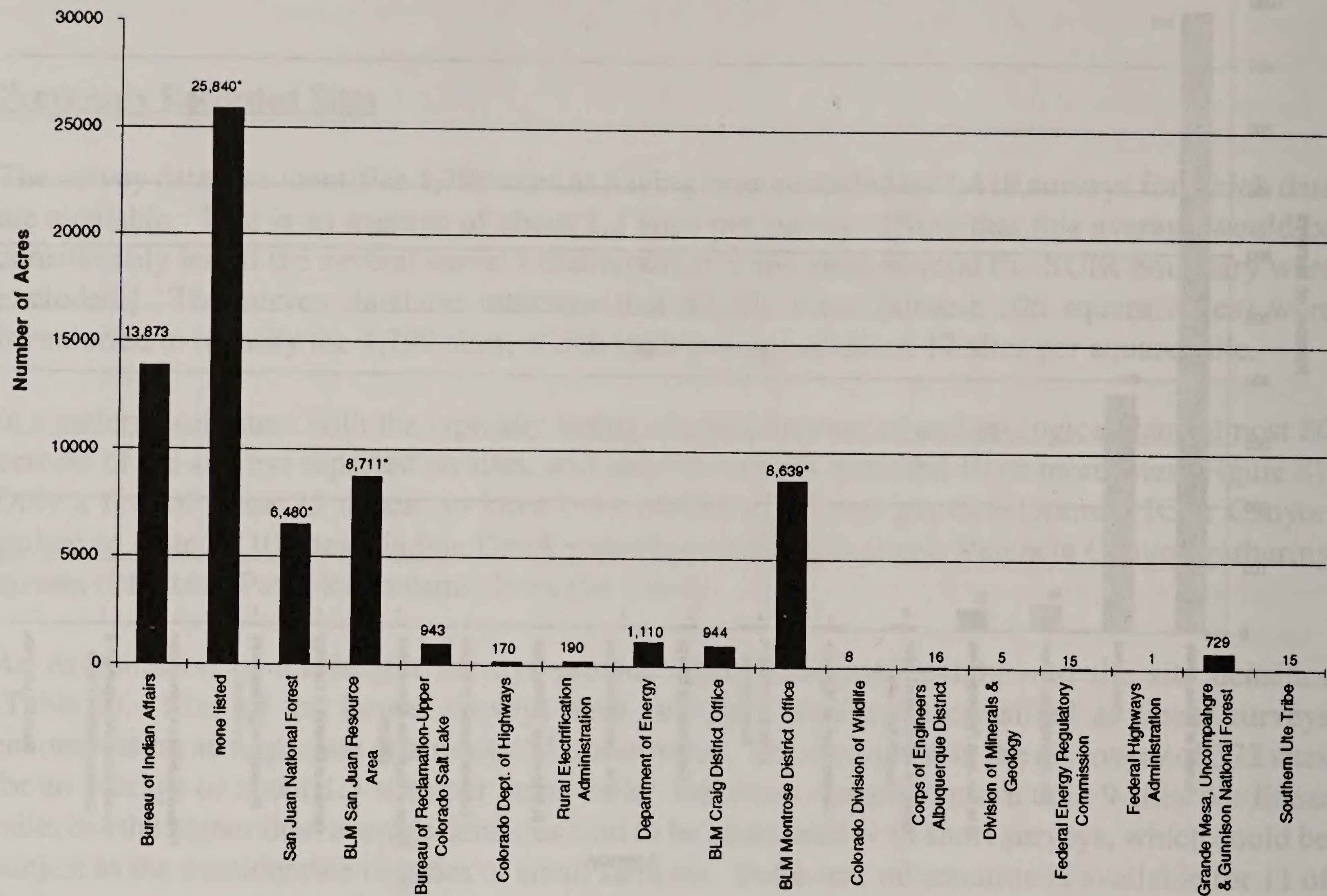
Approximately 24 percent of the sites tabulated in the survey database are associated with BIA surveys (Figure 9). This is more than any other agency (although missing data constitutes 28 percent of the recorded sites), and is expected given that much of the analysis area is Reservation land. The percentage of sites associated with the BIA is identical with 24 percent of the surveyed acreage associated with the BIA (see Figure 3). About 10 percent of the recorded sites are associated with San Juan National Forest surveys, which also is consistent with the 10 percent of the surveyed acreage being associated with surveys by the National Forest. All other identified agencies are associated with less than 3 percent of the recorded sites, except for the BLM Craig and Montrose districts. However, all of the sites associated with those agencies are related to two large, linear projects that are primarily beyond the SUIR boundary (MAPCO and Transcolorado pipelines, respectively).

Figure 2
Number of Surveys per Agency



Source: Colorado Historical Society survey database

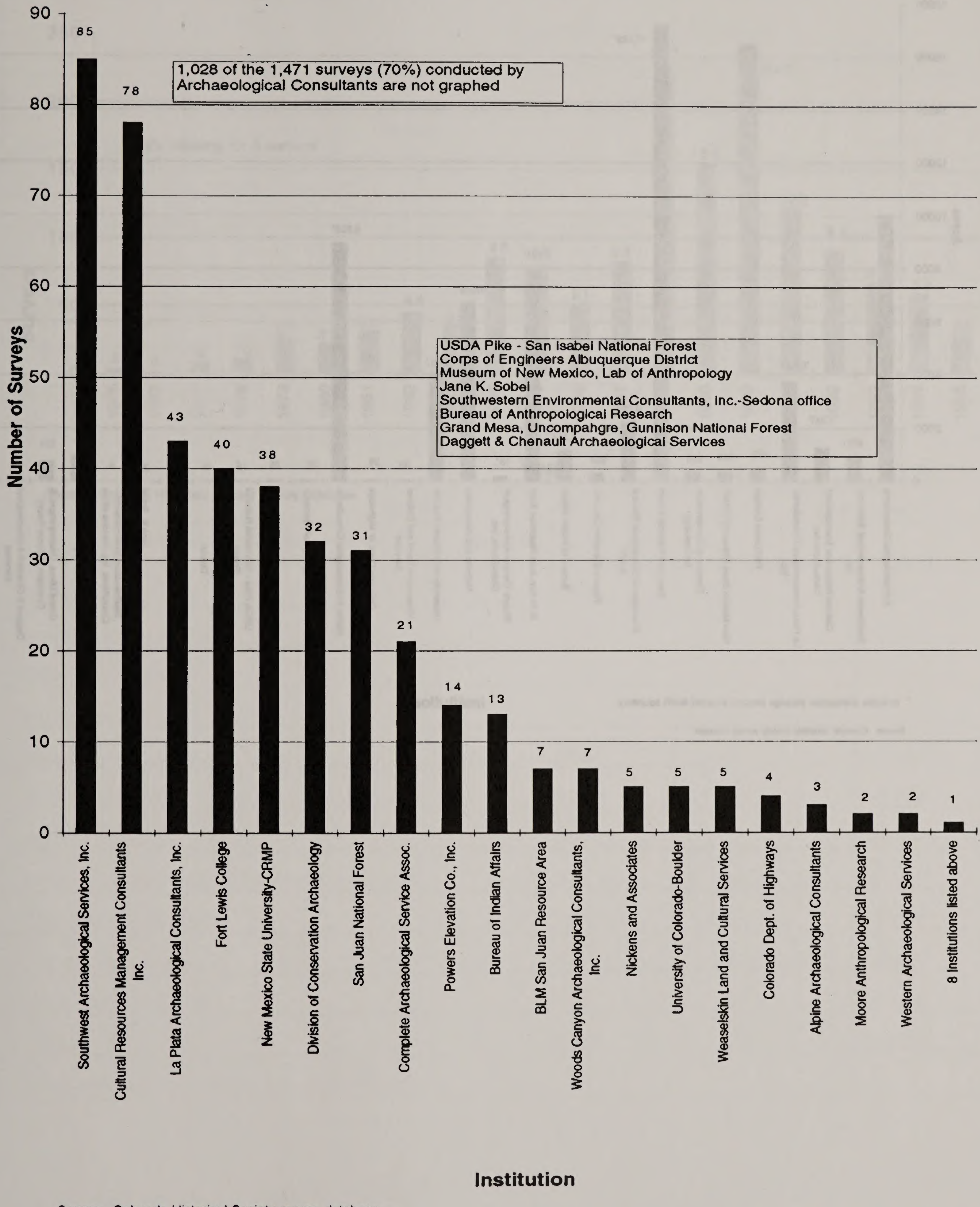
Figure 3
Acreage Surveyed per Agency



* Includes substantial acreage beyond external SUIR boundary

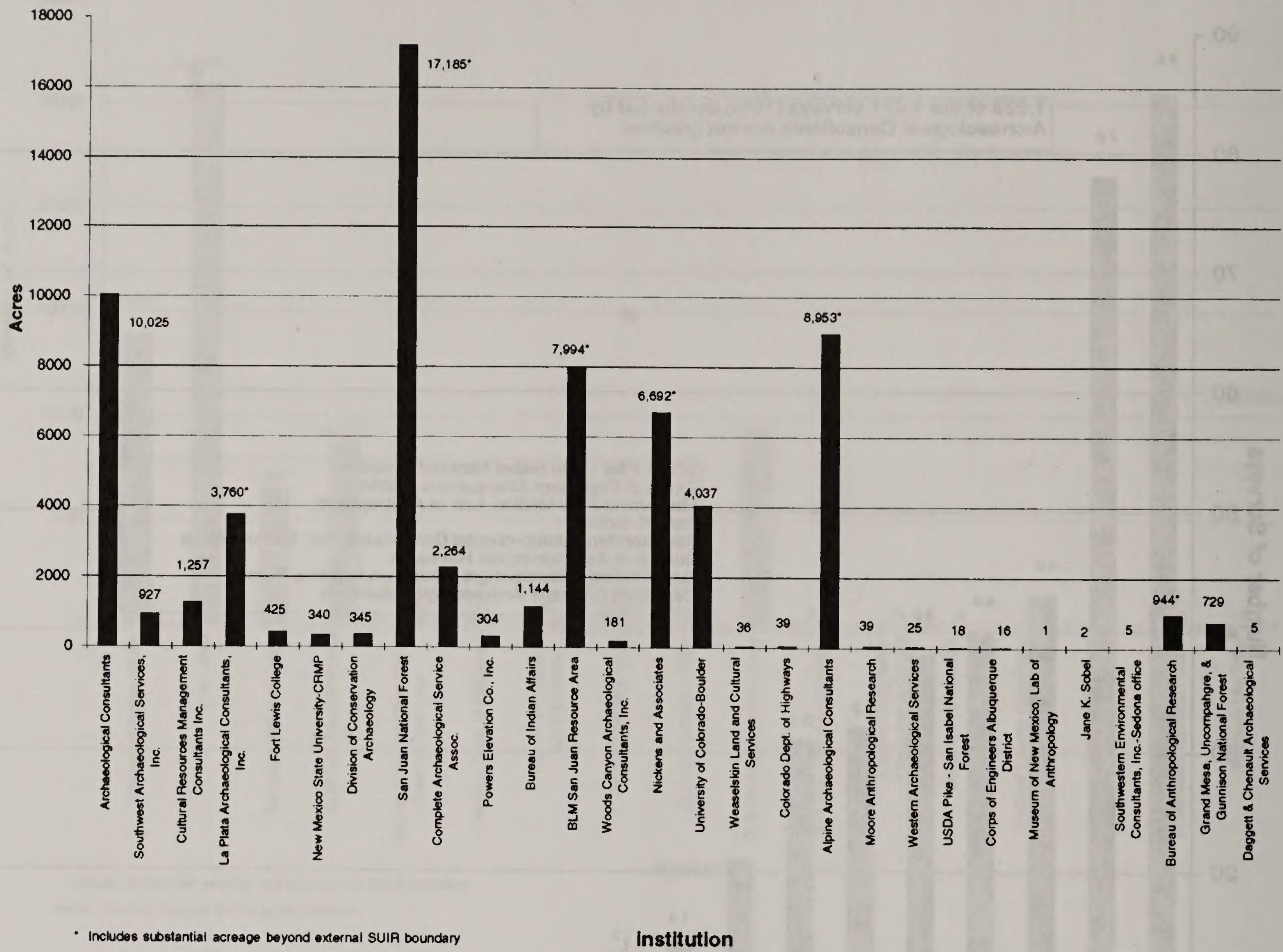
Source: Colorado Historical Society survey ddatabase

Figure 4
Number of Surveys per Institution



Source: Colorado Historical Society survey database

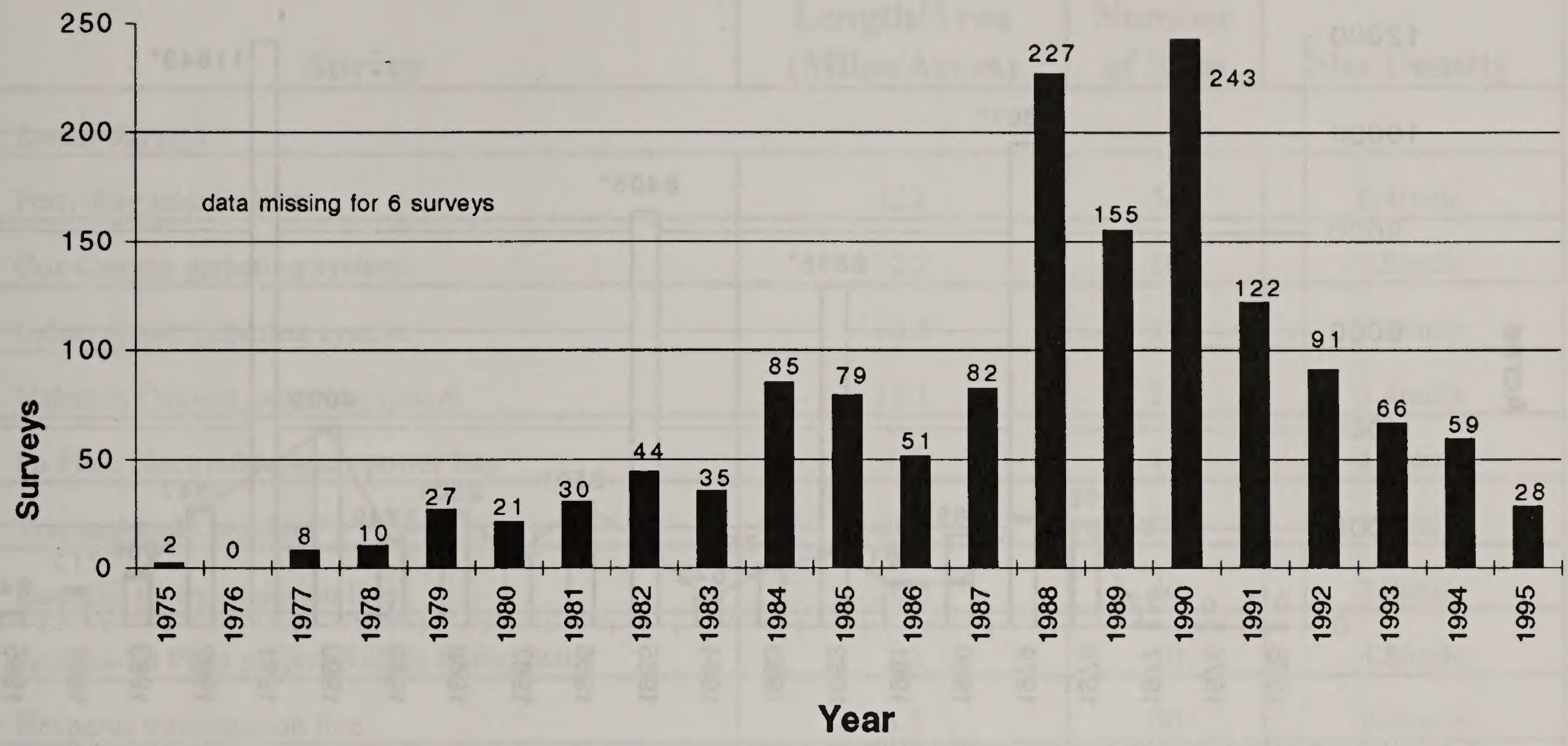
Figure 5
Acres Surveyed per Institution



* Includes substantial acreage beyond external SUIR boundary

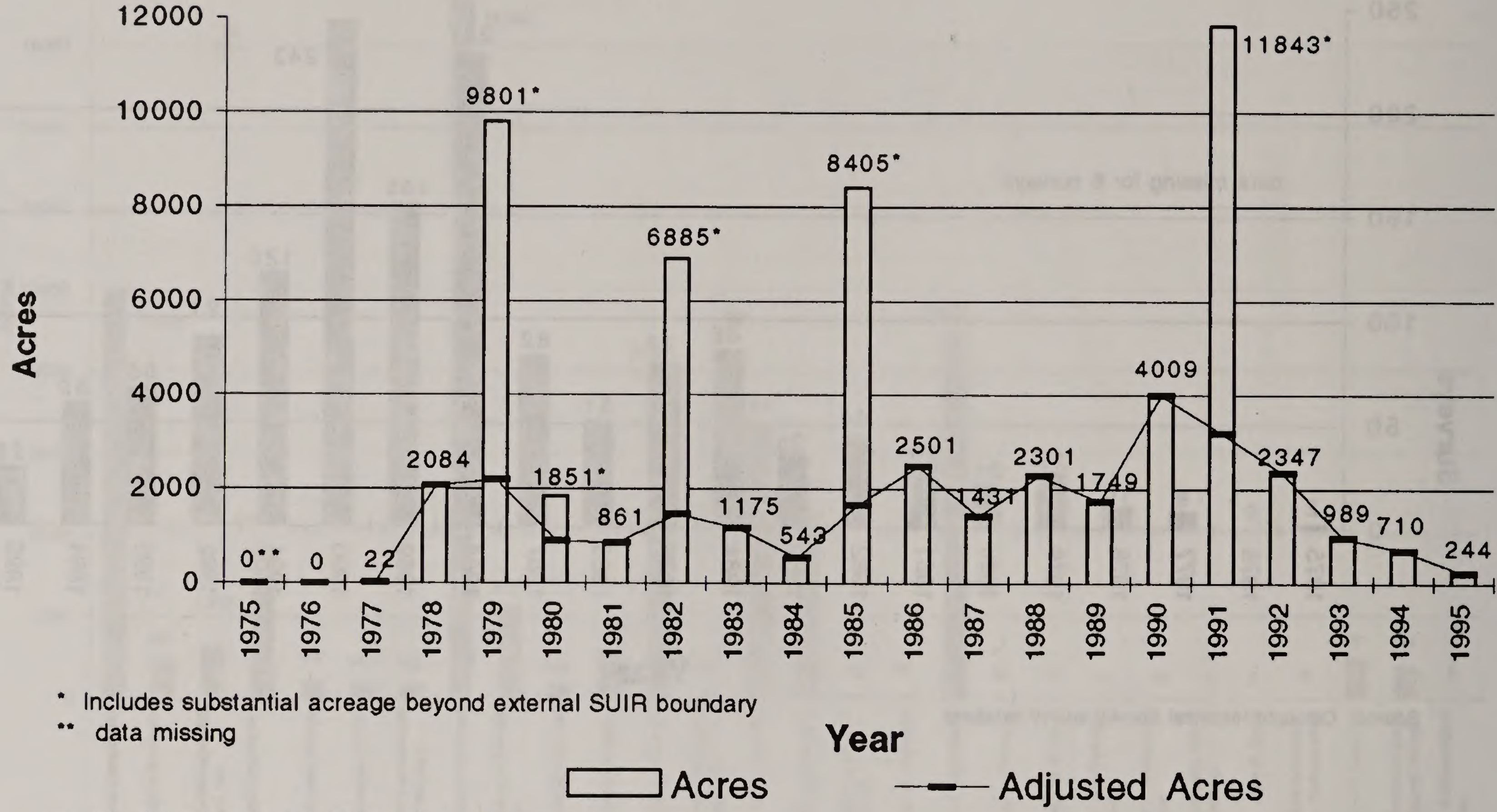
Source: Colorado Historical Society survey database

Figure 6
Number of Surveys per Year



Source: Colorado Historical Society survey database

Figure 7
Number of Acres Surveyed per Year



* Includes substantial acreage beyond external SUIR boundary
** data missing

Source: Colorado Historical Society survey database

TABLE 3 SITE DENSITIES RECORDED BY LARGEST SURVEYS			
Survey	**Length/Area (Miles/Acres)**	**Number of Sites**	**Site Density**
Linear Surveys			
Petty-Ray seismic lines	122	54	0.4/mile
Cox Canyon gathering system	12.2	10	0.8/mile
Indian Creek gathering system	14.3	19	1.3/mile
Valencia Canyon gathering system	15.1	21	1.4/mile
La Plata Electric/Meridian power line	7.7	11	1.4/mile
Transcolorado pipeline*	260	377	1.5/mile
Durango tie transmission line	20.2	40	2.0/mile
Animas-La Plata project Ridges Basin inlet	2.1	10	4.8/mile
Hesperus transmission line	3.2	30	9.4/mile
Totals	456.8	572	1.3/mile
Block Surveys			
isolated BLM tracts*	7,593	13	1.1/mile^2
known recoverable coal*	5,738	73	8.1/mile^2
Chimney Rock area	3,917	91	14.9/mile^2
Spring Creek area	775	24	19.8/mile^2
Bodo Canyon disposal site	640	25	25.0/mile^2
Piedra River corridor	300	12	25.6/mile^2
La Posta borrow pit	300	18	34.3/mile^2
Animas-La Plata Project Wheeler & Koshak units	806	46	36.5/mile^2
Sauls Creek timber sale	400	25	40.0/mile^2
Chimney Rock ravine #4	120	10	53.3/mile^2
Spring Creek watershed	240	22	58.7/mile^2
Totals	20,865	359	11.0/mile^2
* substantial acreage outside external SUIR boundary			

Figure 8
Number of Sites per Survey

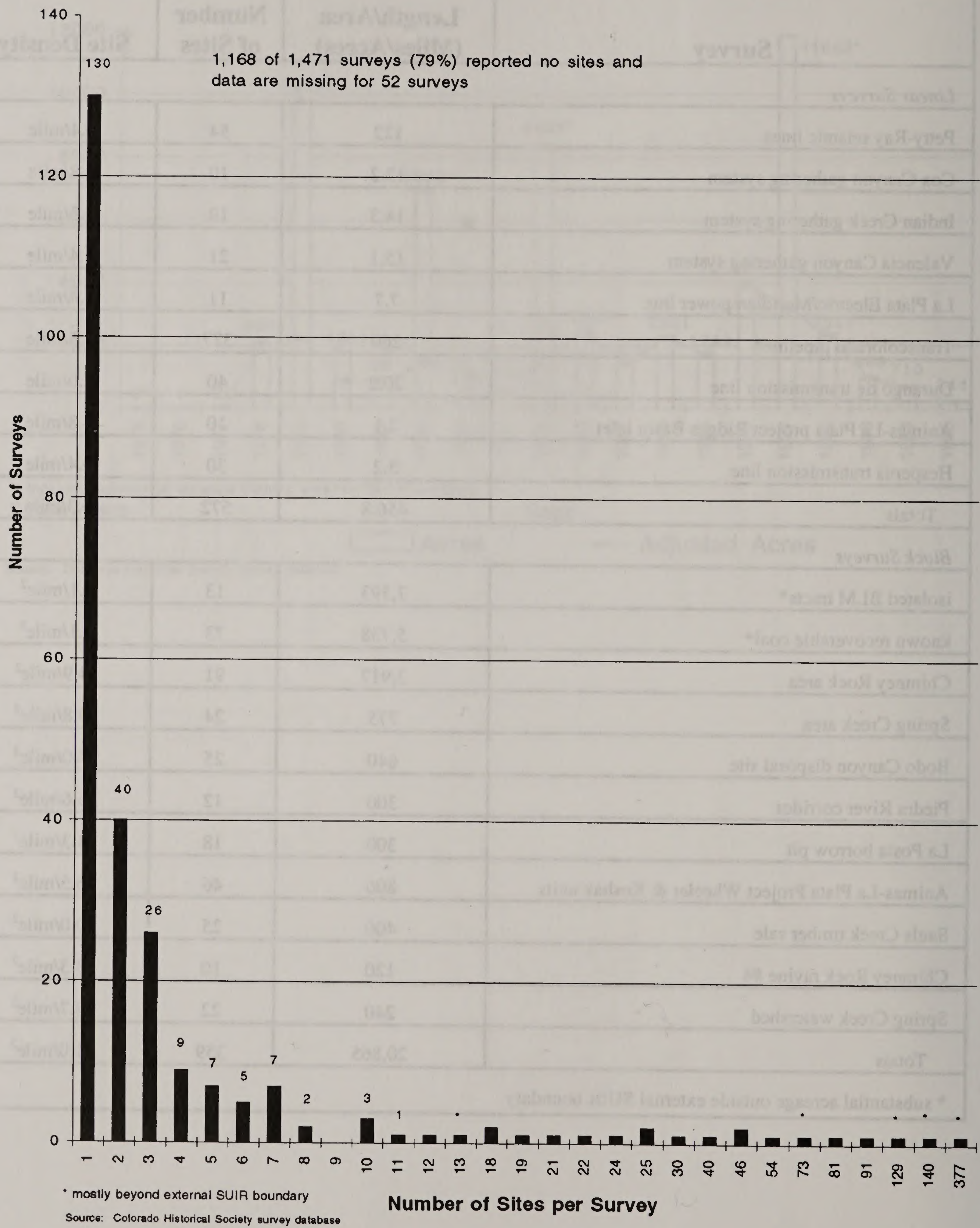
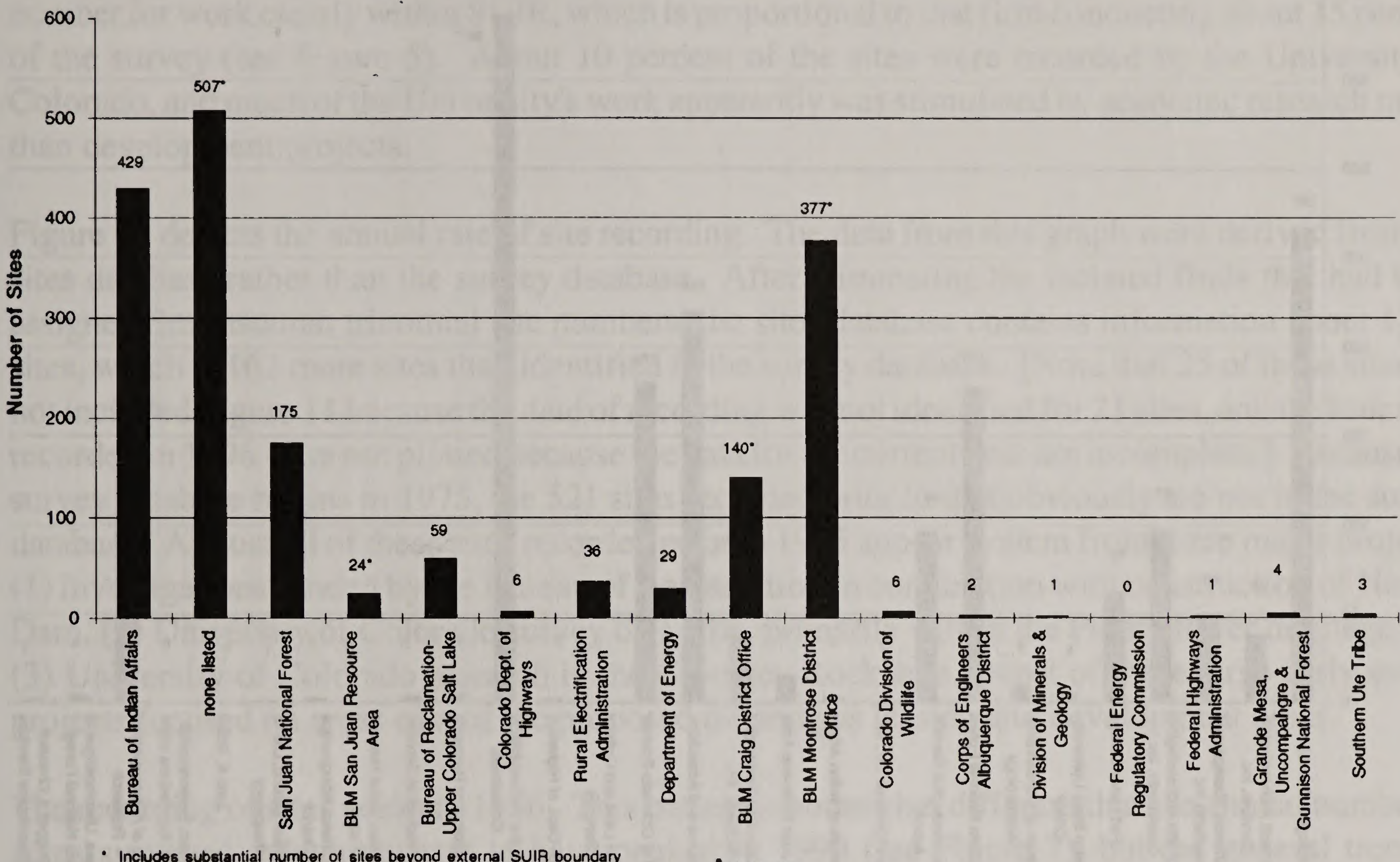


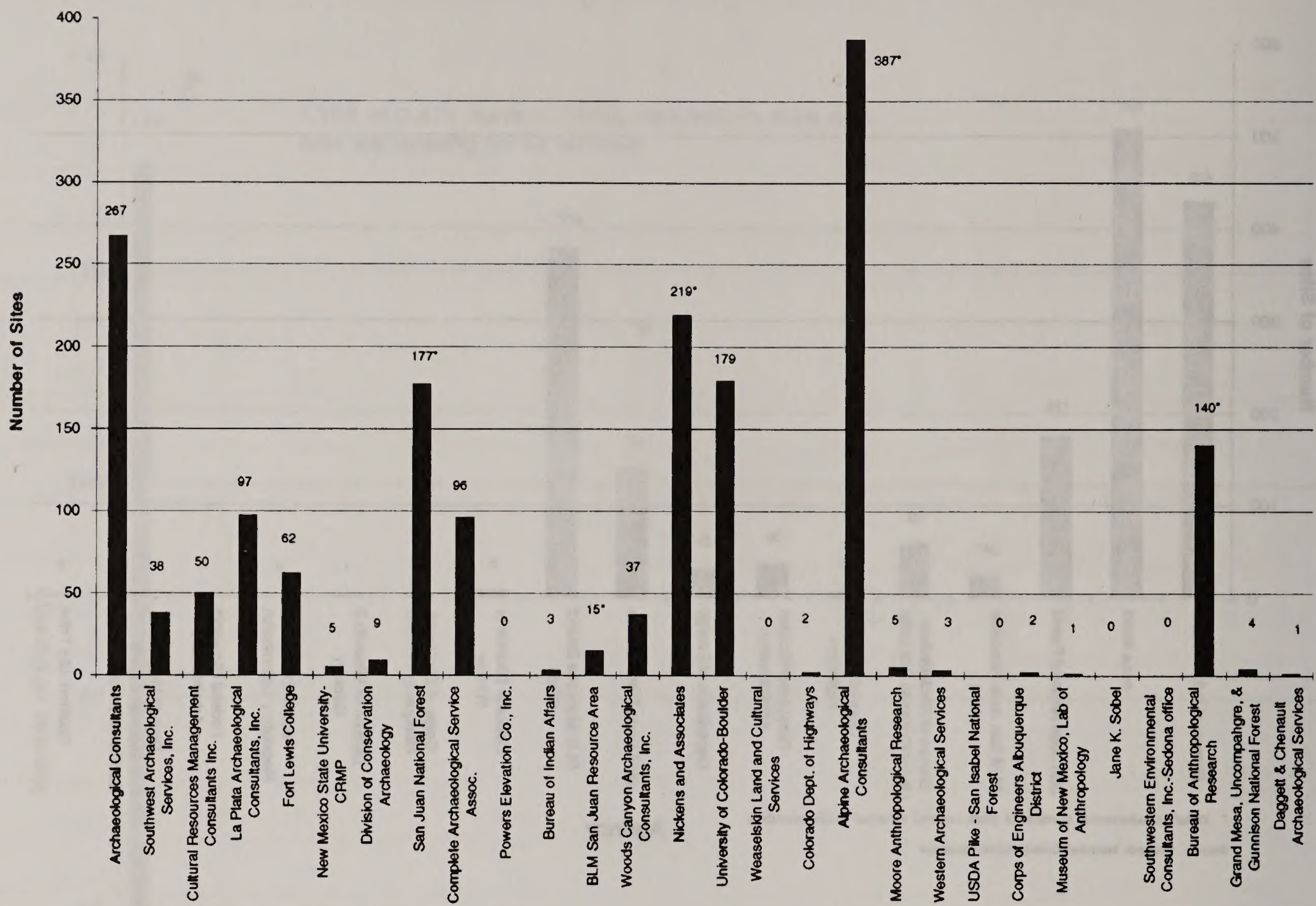
Figure 9
Number of Sites per Agency



* Includes substantial number of sites beyond external SUIR boundary

Source: Colorado Historical Society survey database

Figure 10
Number of Sites per Institution



* Includes substantial number of sites beyond external SUIR boundary

Source: Colorado Historical Society survey database

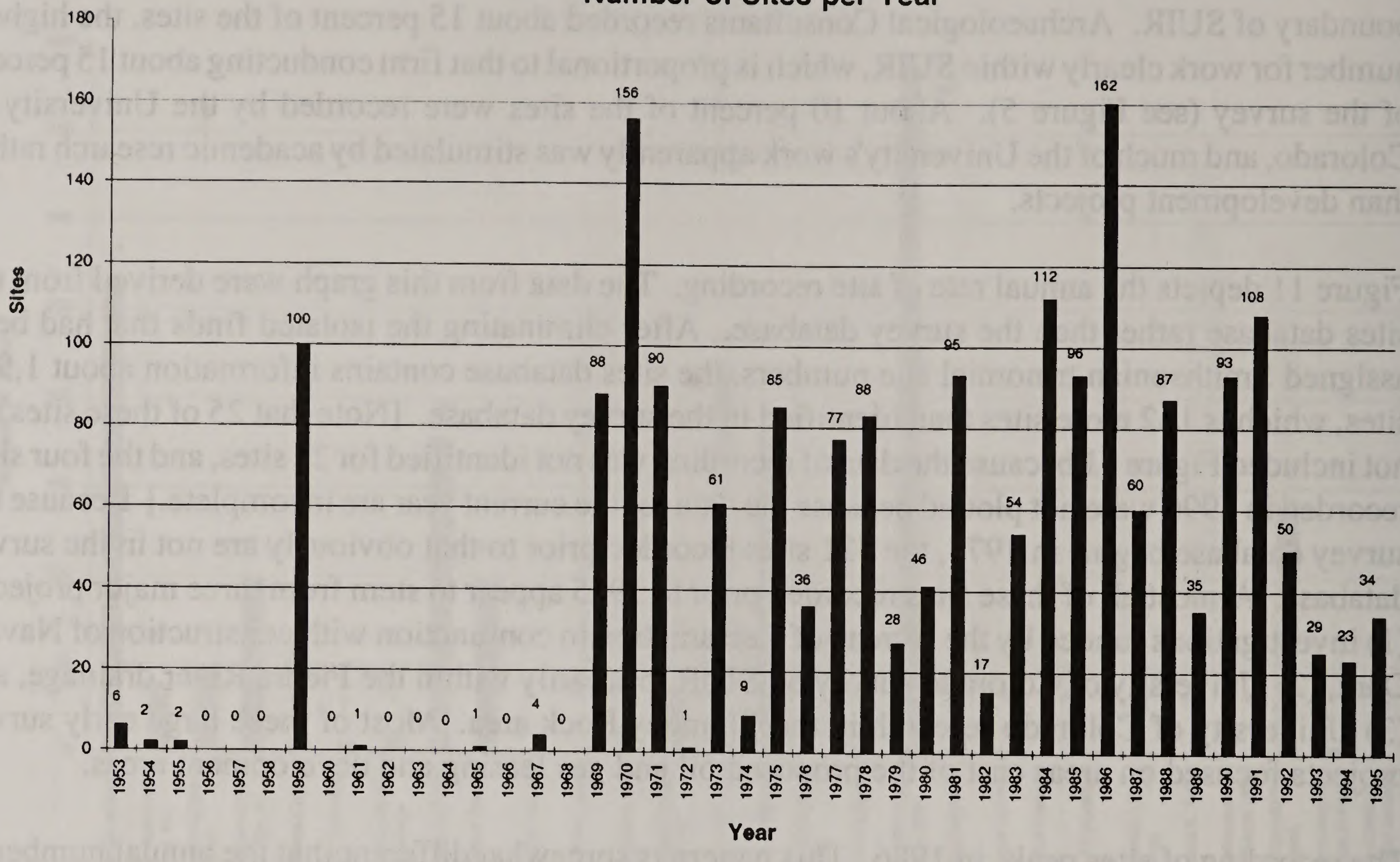
The number of sites recorded by each surveying institution is depicted on Figure 10. Much of the work of four of the six institutions recording the greatest number of sites lies beyond the external boundary of SUIR. Archaeological Consultants recorded about 15 percent of the sites, the highest number for work clearly within SUIR, which is proportional to that firm conducting about 15 percent of the survey (see Figure 5). About 10 percent of the sites were recorded by the University of Colorado, and much of the University's work apparently was stimulated by academic research rather than development projects.

Figure 11 depicts the annual rate of site recording. The data from this graph were derived from the sites database rather than the survey database. After eliminating the isolated finds that had been assigned Smithsonian trinomial site numbers, the sites database contains information about 1,961 sites, which is 162 more sites than identified in the survey database. [Note that 25 of these sites are not included Figure 11 because the date of recording was not identified for 21 sites, and the four sites recorded in 1996 were not plotted because the data for the current year are incomplete.] Because the survey database begins in 1975, the 521 sites recorded prior to that obviously are not in the survey database. Almost all of these sites recorded prior to 1975 appear to stem from three major projects: (1) investigations funded by the Bureau of Reclamation in conjunction with construction of Navajo Dam, (2) University of Colorado survey on SUIR, primarily within the Piedra River drainage, and (3) University of Colorado research in the Chimney Rock area. Most of these large early survey projects focused on areas east of the proposed oil and gas leasing and development areas.

The recording of sites peaks in 1986. This pattern is somewhat different that the annual number of acres surveyed, which appears to have peaked in 1990 (see Figure 7), but the general trend of increasing efforts in the late 1980s and early 1990s is consistent. An average of about 45 sites have been recorded annually during the 43 documented years.

Although the Colorado Historical Society database is not available in geographic information system format, the encoded legal descriptions provide a means to generally plot the spatial distribution of prior survey efforts and previously recorded sites (Figure 12). The data indicate that prior cultural resource studies have been concentrated between Townships 32 and 34 North and Ranges 7 to 11 West. The southern portion of this cluster coincides with much previous oil and gas development, and the northern part may be related more to the Animas-La Plata water project and a uranium tailings disposal project south of Durango. Another area of considerable survey is in Townships 34 North and Ranges 4 to 6 West, and probably relates to investigation of archaeological sites in the Chimney Rock area and other inventory work for various projects on the San Juan National Forest.

Figure 11
Number of Sites per Year



Source: Colorado Historical Society sites database

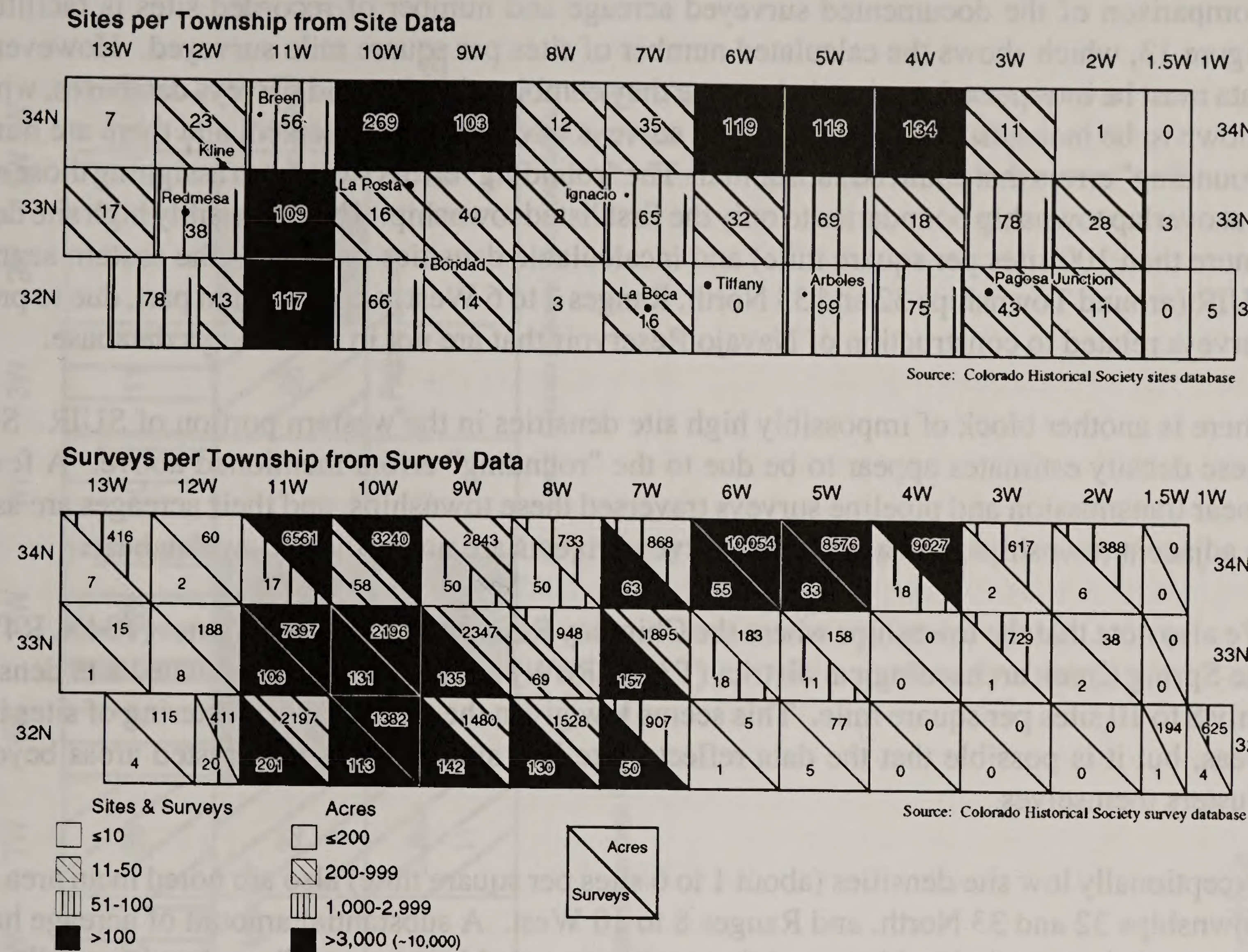


Figure 12 Distribution of Surveys and Sites

Comparison of the documented surveyed acreage and number of recorded sites is facilitated by Figure 13, which shows the calculated number of sites per square mile surveyed. However, these data must be interpreted cautiously because they combine the sites and surveys databases, which are known to be inconsistent. Clearly, not all surveys have been documented, and there are numerous "rounding" errors that could be substantial. The "rounding" errors stem from assigning those surveys that overlap township boundaries to only the first listed township. The impossibly high site densities (more than 100 sites per square mile) and incalculable densities in parts of the eastern segment of SUIR (around Townships 32 and 33 North, Ranges 2 to 6 West) are, at least in part, due to pre-1975 surveys related to construction of Navajo Reservoir that are not in the surveys database.

There is another block of impossibly high site densities in the western portion of SUIR. Some of these density estimates appear to be due to the "rounding" errors mentioned above. A few large linear transmission and pipeline surveys traversed these townships, and their acreages are assigned to adjacent townships, and a few other survey projects are not in the survey database.

We also note that the townships where the Chimney Rock archaeological district (T34N, R4W) and the Spring Creek archaeological district (T34N, R6W) are located have estimated site densities of only 8 to 10 sites per square mile. This seems low given the well known clustering of sites in these areas, but it is possible that the data reflect quite low site densities in forested areas beyond the clusters themselves.

Exceptionally low site densities (about 1 to 6 sites per square mile) also are noted in an area around Townships 32 and 33 North, and Ranges 8 to 10 West. A substantial amount of acreage has been intensively inventoried in this area so the results are probably not anomalies related to small samples. Instead, most of this survey appears to be related to oil and gas development and probably reflects the Southern Ute Tribal policy of working to avoid impacts to any archaeological sites. Projects are routinely modified to avoid sites, and commonly the avoided sites are not recorded, which results in few reported sites compared to the number of acres that are reported surveyed.

Summary of Computerized File Information

The Colorado Historical Society database indicates that prior to the mid 1970s, only three major archaeological surveys were pursued in the region. Because these early efforts focused primarily on the San Juan and Piedra river valleys, they provide little information directly relevant to the proposed oil and gas leasing and development area. To be sure, these studies yielded key information for reconstructing the cultural history of the region, which provides contextual information for evaluation of cultural resources within the project area.

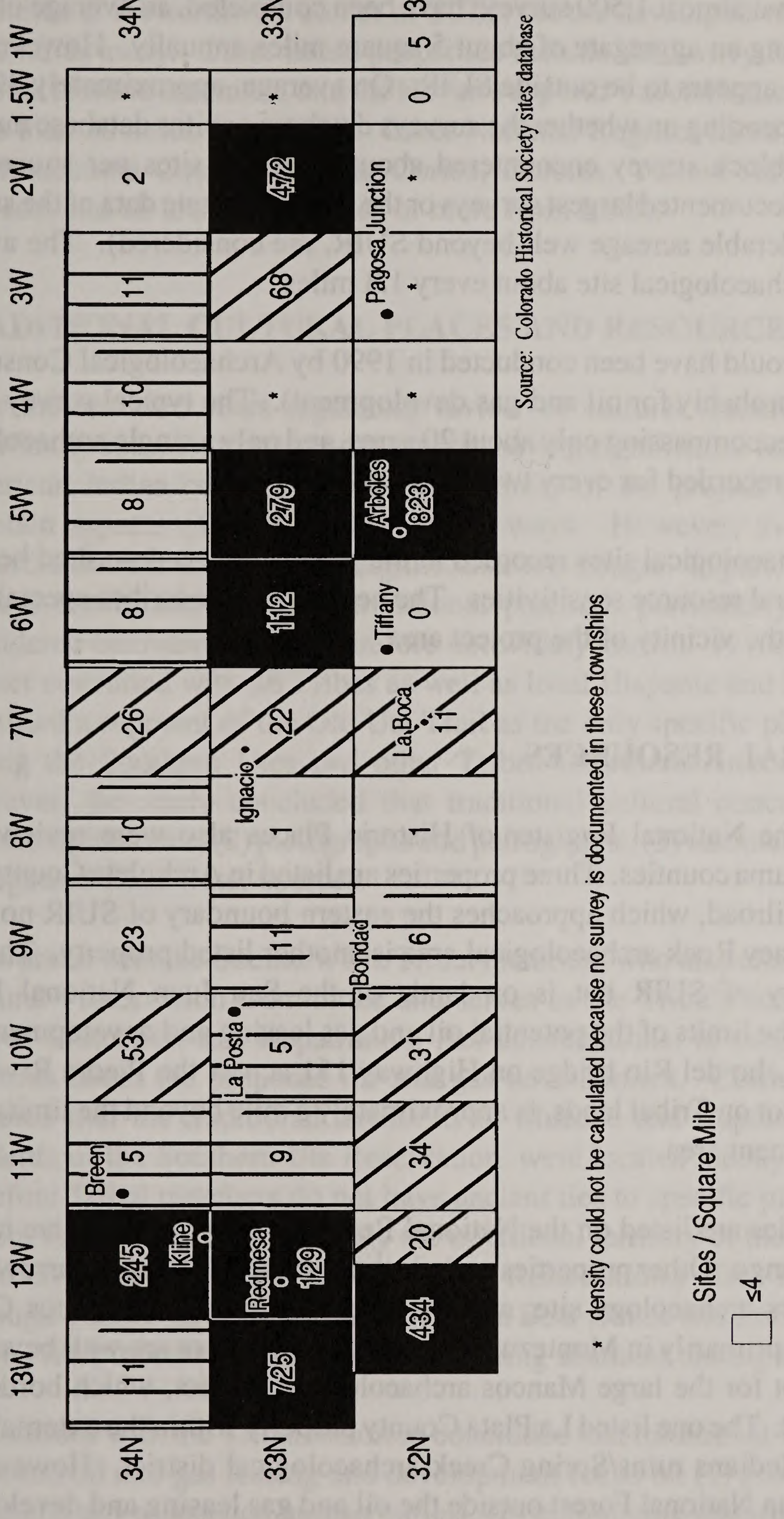


Figure 13 Spatial Variation in Site Densities

Since the mid-1970s the pace of cultural resource inventories grew until about 1990 and has declined since then. The rate of survey seemingly reflects the pace of oil and gas development to a great degree. The database indicates that almost 1,500 surveys have been completed, an average of about 70 surveys per year, encompassing an aggregate of about 5 square miles annually. However, half of this reported survey coverage appears to be outside SUIR. On average, approximately 39 to 46 sites were recorded annually (depending on whether the surveys database or sites database numbers are considered). The average block survey encountered about 11 to 17 sites per square mile (depending on whether the best documented largest surveys or the total aggregate data of the surveys database, which includes considerable acreage well beyond SUIR, are considered). The average linear survey encountered an archaeological site about every 1.3 miles.

The "modal" or typical survey would have been conducted in 1990 by Archaeological Consultants under the auspices of the BIA (probably for oil and gas development). The typical survey would have been a small, block survey encompassing only about 20 acres, and only a single archaeological site would have been found and recorded for every two such typical surveys.

More information about the archaeological sites recorded in the project area is described below in the discussion of modeling cultural resource sensitivities. The next section describes special status cultural resources within and in the vicinity of the project area.

SPECIAL STATUS CULTURAL RESOURCES

The listings of properties on the National Register of Historic Places also were reviewed for Archuleta, La Plata, and Montezuma counties. Three properties are listed in Archuleta County. One is the Cumbres-Toltec scenic railroad, which approaches the eastern boundary of SUIR no closer than about 30 miles. The Chimney Rock archaeological area is another listed property. This area is within the external boundary of SUIR but is on lands of the San Juan National Forest, approximately 10 miles east of the limits of the potential oil and gas leasing and development area. The third property is the 1913 Labo del Rio bridge on Highway 151 across the Piedra River near Arboles. This bridge, which is not on Tribal lands, is approximately a mile beyond the limits of the oil and gas leasing and development area.

Eleven La Plata County properties are listed on the National Register. Most of these are historic buildings or districts within Durango. Other properties include the Durango-Silverton narrow gauge railroad, Durango Rock Shelters archaeology site, and the Ute Mountain Ute Mancos Canyon archaeological district, which is primarily in Montezuma County. All of these are well beyond the external SUIR boundary, except for the large Mancos archaeological district, which borders the entire western boundary of SUIR. The one listed La Plata County property within the external SUIR boundary is the Zabel Canyon Indians ruins/Spring Creek archaeological district. However, the district is on lands of the San Juan National Forest outside the oil and gas leasing and development area, although it borders the leasing and development area. Ridges Basin (La Plata County), along the northern boundary of the SUIR, has been determined eligible as a National Register District, but is outside of the proposed oil and gas development area.

Twenty properties in Montezuma County are listed on the National Register, including Mesa Verde National Park, which also is a designated national historic landmark. The park boundary lies within two miles of the northwest corner of SUIR, but the developed visitor facilities are approximately 8 to 10 miles away. Other listed properties include the Lowry Ruin, which also is designated as a national historic landmark, and the Hovenweep and Yucca House national monuments, but these are more than 20 miles from SUIR. Other National Register listed archaeological and historical sites in Montezuma County are near Cortez, Dolores, Yellow Jacket, Pleasant View, Mancos, and Towaoc, and all are several miles or more from SUIR.

TRADITIONAL CULTURAL PLACES AND RESOURCES

Over the last five years regulatory review of cultural resource issues has broadened to more specifically consider places and resources having significance for traditional cultural groups. Many American Indian communities in the vicinity of the project area, including the Southern Ute, maintain aspects of their traditional life ways. However, available inventories of places and resources of traditional cultural significance are meager. In part, this reflects lack of prior inventory surveys, but information about traditional practices, particularly those related to religion, often are considered confidential and therefore not widely known. A recent study for the Animas-La Plata project consulted with 26 Tribes as well as local Hispanic and Mormon communities. The study identified a segment of the Old Ute Trail as the only specific place of traditional cultural concern among the Southern Utes and other Tribes (Northern Arizona University and SWCA 1996). However, the study concluded that traditional cultural concerns were likely to focus on (1) archaeological sites, (2) pictographs and petroglyphs, (3) resource collecting areas, (4) trails, and (5) springs and other water sources.

We worked with the Southern Ute Tribal historian, who also chairs the Southern Ute Language and Cultural Preservation Committee and serves as the Tribe's coordinator for the Native American Graves Protection and Repatriation Act consultations, to consider potential traditional cultural concerns about the proposed oil and gas development. Consultations with the Tribal historian revealed that the traditional territories of Muache and Capote Ute bands, who are the primary residents of the Southern Ute Reservation, were located mostly to the east of the Reservation and therefore Tribal members do not have ancient ties to specific places within the Reservation. (The current Reservation was primarily the traditional territory of the Weeminuche Band, which is now based on the adjacent Ute Mountain Ute Reservation.) The Tribal historian also indicated that although traditional ceremonies such as the Bear Dance and Sun Dance continue to be practiced by many Tribal members, there are no practicing shamans among the Tribe.

Discussions with the Tribal historian concluded that traditional Ute cultural concerns regarding the proposed oil and gas leasing and development focus on (1) protection of archaeological sites and especially any associated human burials, (2) minimizing disturbance of natural vegetation, and (3) more generally preserving Ute traditions and the environmental resources of the Reservation.

In historic times, the Utes relied on a variety of game animals and natural plant products (Calloway and others 1986). Although no plant products or animals apparently are required for ceremonial purposes, some Southern Utes continue to gather native plants, such as wild onions, as condiments. A variety of other plants are used by some Tribal members as herbal medicines, but there is no documentation regarding the extent of this practice. The utilized species have not been thoroughly inventoried, but include juniper, Mormon tea, lambs quarters, wild spinach, and yucca (Northern Arizona University and SWCA 1996:182).

Concern for preserving Southern Ute cultural heritage does not imply that the Southern Utes desire a life way "frozen in time." In fact, no culture remains static over time. The goal of traditional Southern Utes is to preserve elements of their culture and blend them with the new as their society continues to evolve. No direct linkage has been identified between the proposed oil and gas development and the desire to maintain the Southern Ute language and other aspects of the Southern Ute heritage. The economic benefits of the proposed development, in fact, have the potential to promote self determination and if the Tribe so chooses, funds could be directed to more proactively plan and promote preservation of Southern Ute heritage. In sum, heritage preservation issues do not appear to be significantly related to differences among the alternatives.

Other nearby Tribes, such as the Ute Mountain Ute, Navajo, Jicarilla Apache, Hopi, Acoma, Laguna, Zuni, and other puebloan groups in the northern Rio Grande drainage claim affinity to some archaeological sites located on the Southern Ute Reservation. Other places may have traditional ties for descendants of Euro-American settlers whose families have resided within and near the project area for several generations. No consultation with these groups was undertaken at this generic stage of analysis, because oil and gas development activities on SUIR over the last couple of decades have been successful in avoiding disturbance of human remains, funerary objects, sacred objects, and objects of cultural patrimony that affiliated groups might claim. Subsequent environmental review of specific oil and gas development projects will provide a context for more detailed consideration of traditional cultural issues as warranted.

SUMMARY OF CULTURAL HISTORY

Human societies have lived in southwestern Colorado, as they have throughout much of North and South America, for at least about 12,000 years. The following sections, based largely on previously compiled overviews of the cultural history of the region, briefly summarize the history of this occupation. The aboriginal prehistoric and ethnohistoric eras are described first, followed by a discussion of the historic era defined by the invasion and eventual conquest of the region by Euro-Americans.

<u>Prehistoric and Ethnohistoric Era</u>

The reconstruction of the cultural history of the Paleo-Indian, Archaic, and Anasazi periods is based on archaeological studies conducted within and adjacent to SUIR. Information about Navajo culture history is derived from both archaeological and historical studies. Given the difficulties in identifying the Ute Tradition in the archaeological record (see Buckles 1971; Wormington and Lister 1956), the reconstruction of Ute cultural history is largely based on historical and linguistic sources. Figure 14 depicts the phase sequences and periods of the various cultural traditions known to have inhabited SUIR and the adjacent region.

Paleo-Indian Stage

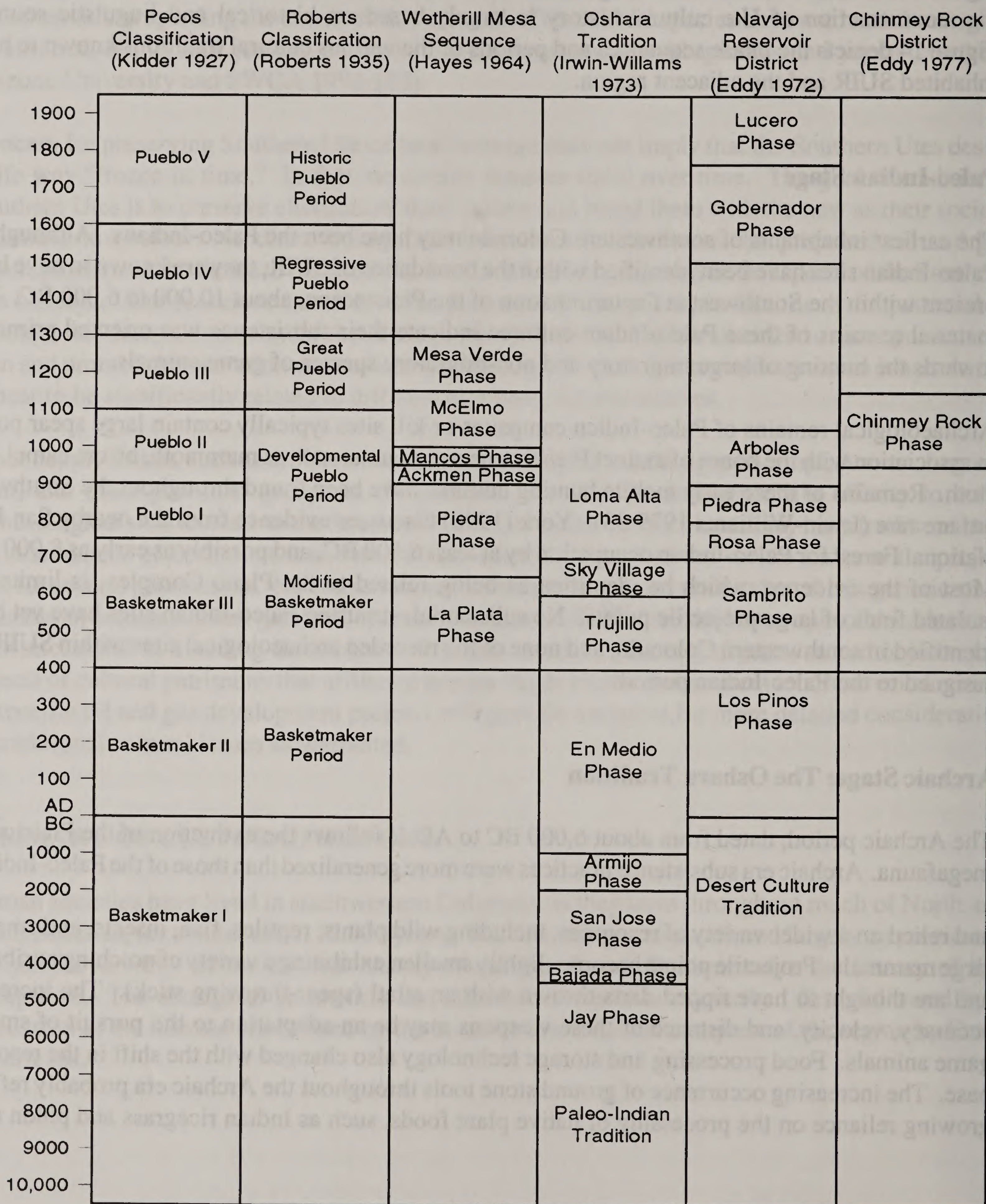
The earliest inhabitants of southwestern Colorado may have been the Paleo-Indians. Although no Paleo-Indian sites have been identified within the boundaries of SUIR, they are known to have been present within the Southwest at the termination of the Pleistocene, about 10,000 to 6,000 BC. The material remains of these Paleo-Indian cultures indicate their subsistence was oriented primarily towards the hunting of large migratory and non-migratory species of game animals.

Archaeological remains of Paleo-Indian campsites or kill sites typically contain large spear points in association with the bones of extinct Pleistocene megafauna, such as mammoth, bison, camel, and sloth. Remains of these early mobile hunting cultures have been found throughout the Southwest, but are rare (Irwin-Williams 1979:33). York (1990) discusses evidence from the nearby San Juan National Forest for Paleo-Indian occupation by at least 6,500 BC, and possibly as early as 8,000 BC. Most of the evidence, which he identifies as being related to the Plano Complex, is limited to isolated finds of large projectile points. No substantial, stratified Paleo-Indian sites have yet been identified in southwestern Colorado, and none of the recorded archaeological sites within SUIR are assigned to the Paleo-Indian period.

Archaic Stage: The Oshara Tradition

The Archaic period, dated from about 6,000 BC to AD 1, follows the extinction of the Pleistocene megafauna. Archaic era subsistence practices were more generalized than those of the Paleo-Indians, and relied on a wider variety of resources, including wild plants, reptiles, fish, insects, and small to large mammals. Projectile points become slightly smaller, exhibiting a variety of notching attributes, and are thought to have tipped darts thrown with an atlatl (spear-throwing stick). The increased accuracy, velocity, and distance of these weapons may be an adaptation to the pursuit of smaller game animals. Food processing and storage technology also changed with the shift in the resource base. The increasing occurrence of ground stone tools throughout the Archaic era probably reflects growing reliance on the processing of native plant foods, such as Indian ricegrass and piñon nuts.

Figure 14
Cultural Stage and Phase Sequences for SUIR



Irwin-Williams (1979) labeled the Archaic culture of the northern Southwest as the Oshara Tradition. She describes a series of phases (Jay, Bajada, San Jose, Armijo, En Medio, and Trujillo) for the Oshara Tradition, each reflecting gradual technological changes, demographic shifts, and decreased mobility throughout the Archaic period.

Archaic period sites have been documented throughout the Southwest. Surveys have noted a particular concentration of large and small Archaic sites in the Ridges Basin area south of Durango (Eddy and others 1984:69-70), and limited excavations have confirmed the presence of a Late Archaic occupation there (Fuller 1988). Of the 35 known Archaic sites within the project area, most (28) occurred in the La Plata River drainage on the far west side of the Reservation. The continuity in material remains of the Oshara Tradition and the Anasazi Tradition suggests a continuum from the Archaic Stage to the Formative Stage (Irwin-Williams 1973).

Formative Stage: The Anasazi Tradition

The transition to agriculture in the Southwest has traditionally been viewed as a gradual process occurring from about 2,000 to 1,000 BC (Woodbury and Zubrow 1979). However, Berry (1982) has made a strong case, given the ambiguous documentation, reporting, and dating of many early Southwestern sites, that maize agriculture was adopted much later at about AD 300. Berry also dismisses the gradual model of culture change. Instead, he proposed a rapid and punctuated transformation, arguing that the introduction of maize was immediately embraced by Late Archaic period peoples, radically altering subsistence strategies and social organization throughout the Southwest. In the Four Corners region, the Formative period of cultural development is represented by the well known Anasazi Tradition.

SUIR encompasses portions of two different branches of the Anasazi Tradition. The Upper San Juan Branch, encompassing the Pine and Piedra river drainages on the eastern side of SUIR, is typified by very early manifestations of village life. The Mesa Verde Branch is represented in the La Plata and Mancos river drainages in the western portion of SUIR, which was apparently occupied throughout the entire Anasazi sequence until regional abandonment at about AD 1300. The Anasazi remains in the Animas River drainage of the central SUIR suggest a stronger affiliation with the Mesa Verde Branch than the Upper San Juan Branch. However, like the Upper San Juan Branch, the Anasazi in the upper Animas drainage apparently abandoned the area sometime during the Pueblo I period (AD 750-950). An outlier of the Chaco Anasazi branch is represented in the Piedra River drainage by the late period Chimney Rock communities.

The Pecos classification, developed by Alfred V. Kidder (1927), outlines a series of cultural developments or periods that are common to most Puebloan traditions in the Southwest, including; Basketmaker II (BMII; AD 100 to 450), Basketmaker III (BMIII; AD 450 to 750), and the Pueblo I through V periods (AD 750-present). The Basketmaker I period is now recognized as the Late Archaic period and the term is no longer used.

Briefly, BMII reflects the initial adoption of corn agriculture in the region. Often, crude pottery is found in association with these remains as are a variety of pit house and surface architectural forms. BMIII is an elaboration of the earlier BMII period, and possibly reflects a greater reliance on agricultural products. BMIII sites are characterized by more formalized and deeper pit structures, and a coil-and-scrape ceramic tradition of gray ware, with some brown ware. The Pueblo I period (PI: AD 750-900) is marked by a switch from pit structures to above ground, contiguous *jacal* (pole and adobe construction) rooms as the primary domestic and storage facilities; and painted and neckbanded ceramics. During the PI period pit structures are believed to have assumed more of a ceremonial function ("proto-kivas"). The Pueblo II (PII: AD 900 to 1100) and Pueblo III (PIII: AD 1100-1300) periods include a transition to masonry architecture, planned town layouts, an elaboration of decorated and corrugated pottery styles, and intensive agricultural practices. The Pueblo IV period (PIV: AD 1300 to 1540) witnessed the abandonment of the Four Corners region and an aggregation of complex settlement systems in the Rio Grande Valley of northern New Mexico, the Upper Little Colorado River watershed, and the Hopi Mesas. The Pueblo V (PV) period, dating from about AD 1540 to the present, refers to the historic Puebloan Indians.

Upper San Juan Branch of the Anasazi Tradition

Dittert and others (1961) proposed a phase sequence of culture change for Anasazi sites in the Navajo Reservoir district that is still widely accepted today, and has subsequently been applied to the Upper San Juan area in general. The sequence includes the Los Pinos (BMII), Sambrito (BMIII), Rosa (early PI), Piedra (late PI), and Arboles (early PII) phases.

Los Pinos Phase (AD 1-400)

The Los Pinos phase heralds the beginning of sedentary life in the project area, and the advent of the Anasazi Tradition. The phase was originally defined during the archaeological survey of Navajo Reservoir (Dittert and others 1961). Subsequent excavations at the reservoir of five sites along the Pine River demonstrated that the phase is a localized expression of the regional San Juan Anasazi BMII culture (Eddy and Dickey 1961). Sedentism based on corn agriculture, permanent houses with shallow, basin-shaped floors, and large subterranean storage pits are the principal traits of the Los Pinos phase. Houses feature roundish to ovate floor plans, central firepits, and walls apparently constructed of stacked logs set with copious mud mortar ("log masonry"). Roofs were probably flat, pole and adobe affairs. Some of the Navajo Reservoir houses were ringed with an apron or pavement of river cobbles while others were not. There may be slight temporal differences between the two styles. Occasionally houses feature a small anteroom, reminiscent of later BMIII houses. Large, subterranean storage pits are found inside and outside the houses.

BMII sites usually lack pottery, but the Navajo Reservoir sites, as well as many other BMII sites throughout the San Juan country, often contain false pottery consisting of unfired clay molded in baskets and tempered with grass or juniper bark fiber. These artifacts may be attempts to replicate pottery known through trade or contact with other pottery making groups. Eddy recovered a few

polished brown ware sherds from Los Pinos sites dating after AD 300. These were originally thought to be of southern (Mogollon) origin. The occurrence of brown wares in the subsequent Sambrito phase has led several researchers to contend these brown wares are locally produced and may represent some of the earliest pottery made in the San Juan Basin (Lister 1993).

Despite the importance of corn agriculture (supplemented with squash), Los Pinos populations retained many elements of the earlier Oshara life ways. Archaic style milling equipment is found in conjunction with corn grinding tools. The atlatl continued as the principal hunting tool.

The original investigators of the Los Pinos phase sites considered the lower Pine River Valley, now under Navajo Lake, to be the center of this local BMII occupation, "but later investigation put the heartland further north, near the small modern community of Bayfield and closer to a second comparable development in the environs of Durango" (Lister 1993: 47). The Durango Basketmaker sites (North Shelter, South Shelter, and Talus Slope Village) are located about 10 miles north of SUIR near the northern city limits of Durango. These sites, considered by many to be the type sites for Basketmaker culture in the northern San Juan Basin, yielded the earliest tree-ring dates in the Anasazi area, but also contain limited evidence of Ute reoccupation during the 17th century (Dean 1975).

Los Pinos sites at Navajo Reservoir range from single isolated houses to house clusters of as many as eleven structures. Sites typically were located at the edge of Pleistocene benches overlooking primary river courses adjacent to or very near floodplains or other tillable lowlands (Eddy 1972).

Sambrito Phase (AD 400-700)

The relationship between the Sambrito phase and the preceding Los Pinos phase is problematic. Eddy (1966) hypothesized a continuum of occupation, placing Sambrito beginnings at AD 400. Later researchers have questioned the validity of the phase because so few sites were found at Navajo Reservoir, and similar sites could not be identified elsewhere with certainty. Following emergency excavations at Navajo Lake in the late 1980s, the Sambrito Phase is presently considered valid (Hammack 1992), although its dating and earlier relationships remain clouded (Lister 1993:59,70-72).

The Sambrito phase is temporally equivalent to the BMIII period in adjacent areas of the San Juan Basin. During the original work at Navajo Reservoir, only seven sites with Sambrito components were encountered, and two of these were questionable. Significantly, none of these sites were recognized during survey. Five were found as buried components under later occupational debris, and the others were masked by non-cultural sediments. Four sites were on Pleistocene terraces while the other three were more dispersed. The small sample provides little basis for positing settlement patterns. Sites contain from one to seven houses, and lack any apparent intra-village patterning.

The first appearance of true pit houses and polished brown ware ceramics are the hallmark of the Sambrito phase. Larger pit houses feature ramp entryways, which along with the brown wares, led

Eddy (1966, 1972) to view the Sambrito phase as an incursion into the area by Mogollon peoples from the south. However, options other than migration should be considered because more recent studies conclude the pottery is locally made rather than being imported (Lister 1993:58). Hard fired, gray ware pottery appears late in the Sambrito phase as a trade ware from BMIII people living in the Animas Valley or regions west towards Mesa Verde and Montezuma Valley.

Rosa Phase (AD 700-850)

The Rosa phase correlates in time and is generally comparable to the early PI period throughout much of the San Juan Basin. The phase was originally defined by Hall (1944) in the Gobernador district south of Navajo Reservoir. At Navajo Reservoir, Rosa phase sites are plentiful; an estimated twentyfold population increase over the preceding phases may be conservative (Lister 1993:60).

More diversified and specialized site types are found during the Rosa phase. Pleistocene benches at or near arable land are still favored locations for permanent houses with secondary preferences in more isolated upland localities. Also, several campsites were found in now buried floodplain deposits yielding evidence of farming activity (Adams 1975; Eddy 1972:29). Large numbers of Rosa phase sites flank the courses of the Pine and Piedra rivers northward well into Colorado.

The general type of site consists of a relatively deep pit house located south of a squarish, jacal surface structure. Refuse (ash, ceramic and lithic discards, and other debris) commonly is located south of the pit house. Pit houses may be small and simple or large with many interior embellishments. Sipapus (small holes in the floor thought to symbolize the place of Puebloan emergence from the underworld) are noted in a few structures. Pit houses occur singularly or in groups of up to six or more.

The relative number of storage pits declines during this period, and the jacal surface structures are now used, in part, for storage. The presence of hearths in a few surface structures indicates some also were used as residences.

The ceramic assemblage includes both locally produced brown and gray wares, the latter occasionally displaying unobliterated coils on the necks of jars and ollas. Simple painted designs in both mineral and organic mediums are sometimes found on the interior of bowls and less frequently on jar exteriors. Other gray wares and occasional red wares from areas to the west appear as trade wares, usually after AD 750. The bow and arrow replaces the atlatl during Rosa times.

Piedra Phase (AD 850-950)

The Piedra phase, corresponding to the late PI period throughout much of the San Juan Basin, was first described by Roberts (1930) on the basis of surveys and excavations conducted in the upper Piedra Valley in the vicinity of Chimney Rock. In the Navajo Reservoir district the phase is marked by demographic shifts northward and upstream in the Piedra and San Juan valleys. Eddy (1972, 1973) views this as a response to headward river entrenchment, lowering water tables, and probably decreasing acreages of arable land. There is no significant increase in the numbers of sites from the preceding Rosa phase, but there are more village-size sites concentrated near tillable soil. For the first time since the Los Pinos phase, Pleistocene terraces lose favor as site locations to more recent and lower valley terraces. Dispersed isolated habitations are widely scattered throughout upland localities.

Pit houses continue to be used as domestic structures with changes limited to interior details. Jacal surface structures become more substantial. Cobblestone and slab foundations are used as basal wall supports, room outlines become more rectangular, and several rooms often are arranged in contiguous arcs or lines. Roberts (1930) defined three structure styles in his Upper Piedra study; two date to the Piedra phase and one to the later Arboles phase. Villages or clusters of pit houses sometimes have an oversize pit house interpreted as a community building. (Because a similar structure was found at the site of Shabik'eschee in Chaco Canyon, these are sometimes called "Shabik'eschee kivas").

Ceramics are little changed from the preceding Rosa phase. Painted designs are better executed and slightly more jars are neckbanded.

Demographic shifts resulting from hypothesized headward channel incision correspond to a period of decreased rainfall and shorter growing seasons. These factors seem to have contributed to desperate social conditions in the Upper San Juan and Piedra valleys. Villages become stockaded, 80 percent of Piedra houses in Navajo Reservoir are burned, and incinerated skeletons and group burials all evidence a deteriorating social environment. With Piedra phase settlements located farther and farther up the San Juan drainage, the Anasazi residents of the region became more and more isolated from contemporary counterparts in areas such as Chaco Canyon and Mesa Verde.

Arboles Phase (AD 950-1050)

The Arboles phase (early PII) is the terminal phase of Anasazi occupation at Navajo Reservoir. Settlements continue to be found farther up the San Juan and Piedra valleys concentrating on valley floors. Also, widely scattered settlements in highland areas such as Middle, Burnt, and Sandoval mesas appear.

Pit houses continue as the principal residential structure with a series of surface structures often arranged in 'L' or 'U' configurations located north of them. The surface structures undergo one important change; most are now constructed with horizontal sandstone slabs set in copious adobe mortar. This constitutes the first true masonry in the upper San Juan region. Shabik'eschee kivas are apparently absent in pure Arboles phase sites.

Though technologically unchanged, ceramics display more embellishment. Many service vessels are now covered with a white slip before painting, and many storage and cooking vessels are corrugated in a distinctive spiral pattern.

Stockades and other evidence of social unrest are lacking at sites with pure Arboles phase components. Although acreages of arable land are still dwindling, social tensions apparently eased.

Research in the Navajo Reservoir area indicates that most Arboles phase residents had left the district by AD 1000, with total abandonment occurring by AD 1050 (Eddy 1972:40). Large numbers of sites dating to the Piedra and Arboles phases are located north of the reservoir in the Chimney Rock-Devil Creek area, and these are considered to be remnants of Anasazi populations from the Navajo district. This area is at the upper altitudinal limit for corn agriculture. Adequate rainfall, better soil conditions, and proximity to mountain resources apparently offset the subsistence stress of the waning years of occupancy in the Navajo Reservoir area.

Chimney Rock Phase (AD 950-1125)

Sites in the vicinity of Chimney Rock near the confluence of Devil Creek and the Piedra River were in relative isolation until the late eleventh century, and residents lived conservative lifestyles. Pit houses continued as the traditional house form, a sharp contrast to developments at Mesa Verde and Chaco Canyon. In the eleventh century, a type of above ground or semi-subterranean pit house appears, featuring massive walls of sandstone rubble and adobe mortar. These were often incorporated with small storage rooms and mealing areas on their northern sides. Sites occur in upland situations and often occupy isolated hilltops, ridges, and other topographic salients (Eddy 1977). The house forms and topographic settings are not unlike developments in the Gallina highlands to the south and southeast in New Mexico.

In the late eleventh century, this isolation came to an abrupt end when Chimney Rock Pueblo was constructed at the base of Piedra Parada. Chimney Rock Pueblo is recognized as an outlier of the Chacoan system, and lies further northeast than any other known outliers. A number of great kivas were built in the immediate vicinity at about this same time or slightly earlier. By AD 1125 Chimney Rock Pueblo and the surrounding Piedra Valley were completely vacated by the Anasazi (Eddy 1977).

<u>Mesa Verde Branch of the Anasazi Tradition</u>

Literature concerning the Mesa Verde Branch of the Anasazi is voluminous, and only the outlines are sketched in this brief summary. BMIII cultural developments in the Mesa Verde region largely parallel those already discussed for the Upper San Juan Branch, but from the early PI period onward

the cultural histories diverge. For the purposes of this discussion we have used the phase designations developed by Hayes (1964) for Wetherill Mesa, which is located 10 miles west of SUIR at Mesa Verde National Park. Those developments seem to parallel those in the western portion of SUIR. Hayes defined six phases of occupation at Wetherill Mesa: La Plata (BMIII), Piedra (PI), Ackman (early PII), Mancos (late PII), McElmo (early PIII), and Mesa Verde (late PIII). The preceding BMII period seems to be absent at Mesa Verde.

La Plata Phase (AD 450-700)

The La Plata phase is equivalent in time and comparable to the regional BMIII period. There seem to be few La Plata phase sites on Mesa Verde, although many may be overlain and masked by later cultural deposits. The phase marks the first appearance of true pit houses, the first locally made pottery, the introduction of beans, the adoption of the bow and arrow, and the domestication of turkeys. Houses occur singularly or in small clusters. Excavations near Yellow Jacket have found instances where BMIII houses were stockaded (Rohn 1975). The houses are usually only partially subterranean, and are roundish, squarish, or roughly rectangular in outline. An entry, ventilator, or antechamber usually is located on the south or southeast side. Storage was in subterranean pits both inside and outside the houses, and they were frequently lined with sandstone slabs.

At Mesa Verde and Yellow Jacket, which are both upland areas, habitation sites are typically found on or slightly below ridge lines, usually widely scattered in linear arrangements (Hayes 1964; Rohn 1977). Dolores Archaeological Project investigations north of Mesa Verde regularly encountered BMIII remains on riverine valley terraces (Kane 1981).

Piedra Phase (AD 700-900)

The Piedra phase, comparable in time and content to the regional PI period, marks the transition from permanent residence in pit houses to above ground structures (pueblos) (Eddy and others 1984). At first these above ground structures were little more than flimsy pole, brush, and adobe huts. By the beginning of the ninth century they were built as concentric rows (one to three rooms deep) forming an arc north or northwest of a pit structure. They are largely constructed of jacal, frequently employing vertical sandstone slabs as basal supports.

Ceramics include plain gray wares, decorated jars and bowls, neck banded jars and ollas. Red ware pottery appears briefly in the record and is both locally made and imported.

As in the Upper San Juan Branch, the Mesa Verde Branch also witnessed population increases and shifting centers of populations during the PI period. At Wetherill Mesa, Piedra phase sites constitute much of the site inventory on the mesa. The Dolores Valley contains vast numbers of PI sites, including components that are now inundated by McPhee Reservoir. Again, Mesa Verde reflects PI occupation in upland situations, in contrast to contemporary sites on the valley floor and canyon bottom terraces in the Dolores Valley.

Ackman Phase (AD 900-975)

The Ackman phase is equivalent in time to the early PII period and is marked by the first appearance of true kivas (Eddy and others 1984:60). These kivas commonly are characterized by a circular or flattened circular plan, have ventilators, and lack southern recesses. The first true masonry in the Mesa Verde area dates to this period, and consists of unshaped and rough shaped sandstone blocks and slabs set in adobe mortar. The lower half of the kiva walls are occasionally lined with masonry, but most masonry is found on the above ground structures. There is continued use of jacal architecture as well. The surface structures consist of linear alignments of a few rooms.

Ceramic additions include corrugation of jar exteriors and rather elaborate black-on-white decorated vessels. Red wares become less and less frequent.

Early PII period sites are found in a variety of situations in both highland and lowland localities. It is noteworthy that much of the Dolores Valley was virtually abandoned by the early tenth century (Kane 1981).

Mancos Phase (AD 975-1050)

The late PII period, or the Mancos phase, is marked by increasing uniformity in kiva construction, refinements in masonry building techniques, and slight changes in site layout. Kivas are still located south of the pueblo, but are found closer and closer to it. The kivas themselves now contain pilasters (usually six of them) to support elaborate cribbed roofs. Most kivas are partially lined with masonry, and early forms of some sort of southern recess begin to appear late in the phase.

Masonry consists of rough-shaped sandstone blocks one course in width, set in adobe mortar. The pueblos are one story, usually linear arrangements of rooms, sometimes forming an 'L' configuration. For the first time, circular towers appear (Hayes 1964).

McElmo Phase (AD 1050-1150)

The McElmo phase heralds the beginning of the Great or Classic Pueblo period, and is well known throughout the Four Corners region. Larger sites and site communities, multistory buildings, improved and often elaborate masonry are all hallmarks of the McElmo phase. Kivas are frequently fully lined with masonry, usually have a 'keyhole' southern recess, and commonly are partially or completely incorporated into roomblocks (pueblos). Masonry is now double course with well finished building blocks, strong enough to support two or more stories of architecture. Water control features, such as check dams, small reservoirs, and ditches are common features (Rohn 1977). For whatever their purpose, towers are now found in increasing numbers, often in direct association with kivas. Late in the phase, construction of many of the cliff dwellings was initiated.

Ceramics become increasingly refined but fewer vessel forms are produced. Firing pits for ceramic manufacture are now common, and are often found in large numbers (Fuller 1984; Hibbets and Harden 1982).

There is a tendency for McElmo phase sites to cluster at canyon heads, canyon rims, or permanent springs. There is little occupation of highland areas.

Mesa Verde Phase (AD 1150 to 1300)

The final Anasazi period in the Mesa Verde region is marked by the appearance of cliff dwellings, which are often quite large. Many of the earlier McElmo phase sites continue to be occupied into this period, often in dense concentrations, at sites such as Yellow Jacket. With the exception of a preference of overhangs and caves for site locations, there is little to differentiate Mesa Verde from McElmo phase sites. Ceramic arts attain their highest levels during the thirteenth century.

Deteriorating climatic conditions probably rank highest among the reasons for Anasazi abandonment of the Four Corners region by AD 1300. The arrival of Athabascan and Numic peoples may also be related to this abandonment, but the timing of these historic events remains clouded.

Navajo Tradition

The affiliation of the Navajo and Apache to northern Athabaskan speaking groups is based on linguistic data that indicate a close relationship of these Southwestern groups with Tribes of the McKenzie River Basin in Canada and the Pacific Northwest. Athabaskan speaking peoples are generally thought to be late comers to the New World as the divergence of the languages and dialects subsumed within this family is relatively minimal (Cassells 1983:187).

Many researchers (for example, Hester 1962) suggest the southern Athabaskans may have migrated from the north into the Southwest via the Great Plains. Brugge (1992:340) believes the Plains Apache (Kiowa Apache, Jicarilla Apache, and Lipan Apache) entered the Southwest via the high plains because they all had a well established Plains adaptation at the time of initial Spanish contact. However, the Southwestern Apache (Navajo, Western Apache, Chiricahua Apache, and Mescalero Apache) may have entered the Southwest from the Intermountain West because these groups evidence few Plains traits, which may be due to causes other than direct Plains culture assimilation.

Historically, the first mention of Navajos in New Mexico by the Spanish dates from AD 1626 when they were first identified as Apache del Nabaju (Hester 1962:Figure 25; Schroeder 1963:5-6, Figure 1). The Spanish initially differentiated the Athabaskans on the basis of those who cultivated crops (Cocoye) and those who were more nomadic hunting groups (Querecho). The Cocoye have been assumed to represent the "proto-Navajo." Governor Oñate mentions the placement of the Cocoye in mountains north of the Jemez pueblos in a letter dated 1598 (Schroeder 1963).

There is much archaeological evidence that indicates the Navajo were present in "Dinetah" (the Largo and Gobernador region of northwestern New Mexico) at least by the 1500s, while some evidence suggests they may have been in the region by 1350. Hancock (1992) reports numerous dates from Navajo sites in the nearby La Plata River valley from 1350 to 1675. Marshall (1985) reports dates from Navajo sites in the Blanco Canyon area at 1550 ±55 and 1590 ±55. A review by Winter and Hogan (1992:Figures 26.2 and 26.3) of 31 radiocarbon and 20 thermoluminescence samples obtained from early Navajo sites in the San Juan drainage leaves little doubt that by approximately 1500, and probably earlier, the Navajo inhabited the region. However, the attributed Navajo affiliation of these early sites has been questioned (Schaafsma 1993).

Few chronometric dates have been obtained from SUIR, but the early Navajo sites frequently encountered on SUIR have virtually identical types of artifact assemblages, features, and structural remains as the dated sites in northwestern New Mexico. There can be little doubt that portions of SUIR were inhabited, at least on a seasonal basis, by early Navajo emigrants.

Navajo cultural history has been divided into a number of phases, including: Dinetah, Gobernador, Piedra Lumbre, Cabezon, and Reservation phases. The Navajo abandoned the upper San Juan region by 1750 due to intensive conflicts with the Utes and Comanches. Accordingly, only the earlier Dinetah and Gobernador phases are reviewed here.

The Dinetah phase was initially defined by Dittert (1958) who noted a pattern in which some sites contained Dinetah Utility sherds, but lacked Gobernador Polychrome and other Puebloan trade wares. He postulated that these sites were occupied earlier (about 1550 to 1700) than the Gobernador phase sites (1700 to 1775), and that these sites lacked many other traits associated with Puebloan influence. The definition of the Dinetah phase was criticized for its reliance on negative traits (Eddy 1966:505-508; Schoenwetter and Eddy 1964:21).

However, recent work in the upper San Juan region has confirmed the presence of a "pre-Gobernador" Navajo occupation (Winter and Hogan 1992), which may reach back as far as 1350. The Dinetah Phase still remains ill defined but generally refers to sites that yield Dinetah Utility sherds (an overfired gray ware) and appear to lack Puebloan trade wares and other forms of Puebloan influence. The Dinetah phase Navajos built and used a variety of structures, including forked-stick hogans, sweatlodges, ramadas, and other log and brush structures. Subsistence appears to have been oriented around a generalized hunting and gathering economy, although some evidence suggests the cultivation of corn. There is no evidence that conclusively indicates that Navajos were engaged in pastoral activities at this early time.

The Gobernador phase (1770-1775) has historically been viewed as a time of intense interaction and acculturation between Navajos and Pueblo refugees, following the reconquest of New Mexico by the Spanish in 1692. Kidder (1920) was the first to suggest that the masonry pueblitos in the Largo-Gobernador district were built by Puebloan peoples who were hiding from the Spanish among the Navajos. Spanish documents indicate that after the 1680 Pueblo Revolt, many Puebloan populations feared armed reprisals and fled the northern Rio Grande to seek refuge among the more isolated Hopi, Zuni, and Acoma Indians, while smaller numbers moved to the north among the Navajos

(Dozier 1966; Hogan 1991). In particular, many researchers note that the Jemez, Santa Clara (Tewa), and Cochiti Puebloans fled north and lived with Navajos as refugees for a considerable time (Brugge 1983:493; Carlson 1965:57). It was probably during this period that Puebloan traits became most widely incorporated into Navajo culture.

The Gobernador phase was first defined by Kidder (1920), Keur (1944), and Carlson (1965). Material traits diagnostic of the Gobernador phase, as reviewed by Dittert and others (1961:246), include forked stick hogans; pueblitos; ramadas; fortified sites; undercut cooking pits; metate rests; slab mealing bins; cist burial; cremation (?); pictographs and petroglyphs; Dinetah Utility pottery; Gobernador Indented pottery; Puebloan tradewares; chipped artifacts; slab metate with two hand mano; oval, single groove arrow shaft smoothers; gilsonite pendants; trade stone material from the Abiquiu area; bone awls; uninterlocked, close-coiled two-rod-and-bundle basketry; wooden basketry awls; fire drill and hearth; wooden scoops; *Yei*; Twin War God deities; sheep and horses; weaving; *Olivella* shell beads; distinctive types of corn and beans; stone masonry hogans; cribbed log hogans (?); sweatlodges; wooden plows (?); notched-log ladders; digging sticks; dance paddles; macaw fetishes; metal; and glass beads.

Carlson (1965:101) noted that settlement patterns changed significantly during the Gobernador phase. Specifically, early Gobernador phase sites, as described for the Navajo Reservoir district (Eddy 1972), consist of hogan clusters with small (1 to 4 room) pueblitos. Late Gobernador phase sites are large masonry citadels located in difficult to access defensive positions. Tree-ring studies from these later, larger defensive settlements indicate construction occurred primarily from 1715 and 1750, well after the Spanish reconquered Santa Fe in 1692 and defeated the last uprising in 1696.

Traditionally, the pueblitos of the Gobernador-Largo district were thought to represent defensive sites built by the Pueblo refugees who were among the Navajos after the failed 1696 uprising against the Spanish (Kidder 1920). Increased raiding of Pueblo and Spanish settlements by the Navajos initiated the successful Roque de Madrid's campaign against the Navajos in 1709. By laying waste to the corn fields, the Spanish suppressed the Navajos and brokered a rare peace agreement that occurred between 1709 to 1760. McNitt (1972:22) observes that there is not a single reference to Navajo raids on Spanish settlements during this period, which, oddly enough is when the majority of the large defensive pueblitos were constructed. Carlson (1965) proposed that the construction of the large defensive pueblitos were a response to the initial Ute and Comanche advance, at about 1716 to 1720, because most of the Pueblo refugees had long since returned to the Rio Grande Valley by then. The large defensive pueblitos, then, were probably not built by the Puebloan refugees to defend against the Spanish, but were probably constructed by Navajos to defend against the raiding of goods, livestock, women, and children by the formidable Ute-Comanche alliance. The breakdown in the Spanish-Navajo truce after 1760 and the continual intensive raiding and warfare by the Utes forced the migration of the Navajos south and west of the San Juan River to their present homeland by approximately 1775.

Numerous Gobernador phase sites have been encountered on SUIR in the Animas, Pine, and La Plata river drainages. These sites typically have Dinetah Utility, Gobernador Polychrome, and Puebloan trade ware pottery. Forked-stick hogans can occur on these sites, but masonry pueblitos are absent.

The presence of chipped stone tools and waste debris, as well as ground stone implements, suggests resource acquisition and food processing commonly occurred on these sites.

The lack of early or late Gobernador pueblitos probably indicates two possibilities. First, SUIR may have only been used by the Gobernador phase Navajos on a seasonal basis, probably for hunting and gathering of native plant and animal resources. The other possibility is that by the early Gobernador phase, intensive raiding and warfare by the Utes and Comanches pushed Navajos further south and restricted them to the Largo-Gobernador district, where they built and finally abandoned the large defensive pueblitos by 1775.

Ute Tradition

The Utes speak a Shoshonean language, which is a branch of the larger Uto-Aztecan language family. Other Shoshonean speakers include Great Basin groups, such as the Paiutes, Goshutes, and Shoshones, as well as various Tribes in California, and also the Hopis.

Most research that has attempted to tie archaeological remains to the Utes has been inconclusive. In particular, it is impossible to distinguish Ute remains from those of the more general Great Basin "Desert Culture," at least prior to the introduction of the horse (Buckles 1971; Wormington and Lister 1956), suggesting that Ute life ways were very similar to those of Great Basin groups.

The Desert Culture is a very long-lived hunting and gathering adaptation utilizing a "wide spectrum economy" of native desert plant and animal resources, including seeds, roots, nuts, small and large mammals, fish, insects, and birds. Excavations of such sites as Danger Cave (occupied intermittently from 8300 BC to AD 1400) and other Great Basin sites (Jennings 1957, 1964) indicate that Desert Culture groups were organized into small mobile bands that pursued annual foraging rounds driven by the seasonal availability of various natural resources.

The inability to distinguish the archaeological remains of the Desert Culture from that of the Utes has led some researchers to conclude that the early, long-lived Desert Culture of the eastern Great Basin is ancestral to the historic Utes and other Numic speaking groups (Fowler and Fowler 1969:20-21; Smith 1974:15-17). While there is much disagreement regarding the fate of the horticultural Fremont groups, a northern manifestation of the "puebloid" culture dating from about AD 400-1150 (Stewart 1966), many authors believe that Shoshonean speakers expanded from the Death Valley, California region and fanned out through the Great Basin, with the Utes probably reaching the Gunnison Basin area of west-central Colorado possibly by AD 1150 (Fowler and Fowler 1969; Goss 1968; Miller 1966, 1984:102; Smith 1974). On glottochronological grounds, Lamb (1958:99) argues a strong case that the entire Numic branch originated in the southwestern portion of the Great Basin and only began diverging and migrating eastward and northward some 1,000 to 2,000 years ago.

The Numic Branch of the Uto-Aztecan language family is the most northerly branch of the family, encompassing the Great Basin from southern Idaho to southern California (Miller 1986:98). The

Southern Numic language subdivision includes the Ute, Southern Paiute, and Chemehuevi peoples. The minimal dialectical differences between these groups further ties and associates the Utes with a Great Basin origin. All dialects from these groups are mutually intelligible, suggesting a very recent divergence from one another (Miller 1986:98-99). The dialectical differences within the Ute language suggest that the divergence of the dialects it subsumes may have begun about 400 years ago (Goss 1968; Miller 1986:100).

The Ute Indians were organized into several bands at the time of historic contact. The Muache, Capote, and Weeminuche bands make up what became known as the Southern Utes. The Capote and Muache bands appear to have utilized the project area only periodically prior to confinement on the present day Reservation by the United States military. The Muache and Capote bands currently reside on SUIR centered in Ignacio, while the Weeminuche live on the Ute Mountain Ute Indian Reservation surrounding Towaoc.

The Capote band inhabited the area south of the Conejos River, east of the Rio Grande River to the Sangre de Cristo Mountains and east of the Continental Divide. The San Luis Valley was also frequented by the Capote band, who traveled as far south as the region around Chama and Tierra Amarilla, New Mexico. The Muache band lived in areas east of the Culebra and Sangre de Cristo ranges between the vicinity of Trinidad and Denver (Schroeder 1965:54). After the acquisition of the horse, the territories of the Capote and Muache bands shifted in response to warfare with other groups encroaching on their traditional ranges, particularly the Navajos, Spanish, Comanches, Cheyenne-Arapahoe alliance, and the Anglos. Schroeder (1965) cites many instances of these bands roaming well into northwestern New Mexico and southwestern Colorado. The Weeminuche band inhabited southwestern Colorado west of the Continental Divide, to the Abajo Mountains and canyon lands of eastern Utah, while the San Juan River was the southern boundary of their range.

Schroeder's (1965) intensive archival research documents that the three Southern Ute bands were in the vicinity of the project area by the 1600s, although their occupancy in the area probably occurred even earlier. The first definite Spanish reference to the Utes (Capote band) was in 1626. The reference was derived from accounts of residents of Jemez Pueblo who said they had visited the area just prior to Spanish settlement of the region in 1598, and reported the Utes lived in thatch-covered huts north of the San Juan River, beyond where the Navajos lived (Gobernador-Largo region).

During the period 1637 to 1641, the Spanish waged war on the Utes in southern Colorado, without provocation (Schroeder 1965:54), and 80 Utes were captured and enslaved in a workshop in Santa Fe. Intermittent raiding and warfare continued to the 1670s and the Spanish had forced more Utes into slavery, although during this period the Utes had begun capturing and obtaining horses. The acquisition of the horse dramatically changed the lives of the Utes and by 1670 they had become such a fearless and formidable force that the Spanish arranged their first treaty with them.

During the Pueblo Revolt period (1680-1696), the mounted Utes would organize large parties and raid the northern pueblos of the Rio Grande. The southern extent of the Capote band at this time was the San Juan River. Schroeder (1965:56-57) speculates that rather than Spanish antagonism, raids against the Hopi by the Capote band forced the Hopis to relocate to the top of the Hopi mesas, and

probably out of Canyon de Chelly as well. The Hopis clearly view the Utes as their traditional enemies (Amsden 1949:128, note 7), which supports Schroeder's interpretation.

Since the 1670s, the Muache band had been building a strong alliance with their linguistic relatives, the Comanches. During this period, the incredibly strong and feared Ute-Comanche alliance, waged warfare and raiding on the Puebloans and Jicarilla Apaches with increasing frequency. Into the 1700s, the Ute-Comanche alliance roamed great distances, venturing onto the Great Plains north of the Arkansas River in Colorado. Northern New Mexico settlements, Pueblo, Navajo, and Spanish alike, suffered endless attacks and raiding by the Muache and Comanche alliance up to the late 1740s. The continual conflict with the Navajos resulted in Navajo settlement in the pueblitos of the Largo-Gobernador area for defensive purposes (Schroeder 1965:58), as discussed previously. This clearly places the Muaches in the Largo-Gobernador region by the early 1700s. Likewise, attacks on Abiquiu, Ojo Caliente, Embudo, and Quemado by the Ute-Comanche alliance had destroyed much of these Spanish settlements. Meanwhile, the Capote band had begun serious raiding east of the Continental Divide by 1736. By 1752, the Muache-Comanche alliance had broken down as the Comanches began to dominate the western plains due, in part, to the acquisition of guns from the French (Schroeder 1965:59).

By 1754, the Spanish had reached peace with the Utes and even Abiquiu was reinhabited. The Spanish needed this alliance with the Ute bands as they posed a formidable force and buffer to the Spanish against their enemies. The trade in deer skins from the Utes was also highly sought and considered important by the Spanish. Also in 1754, the Muache band formed an alliance with the Jicarilla Apache. The Spanish were very careful in cultivating their relationship with their Ute allies. Spanish trading ventures into Ute territory had to be properly authorized and the Spanish pursued and punished criminals who committed crimes against the Utes.

The Capote band formed a relationship with the Navajos after 1750, and the two groups even joined forces in 1785 to attack Gila Apaches in the San Jose River region. The relationship struck by the two groups alarmed the Spanish who imposed a ban on trading with the Utes.

In 1779, the Muache band and their Jicarilla and Spanish allies took part in a successful battle against the increasingly powerful Comanches. By 1786, the Spanish, Muache band, and Comanches negotiated a peace agreement. The Utes formed a tight relationship once again with the Spanish, and in 1804 the Muache-Jicarilla alliance joined the Spanish in a campaign against the Navajos.

The Weeminuche band was reported to be living with Navajos near the Carrizo Mountains in 1818, and they combined forces for periodic raiding excursions. In 1821, Mexico gained independence from Spain. The Mexican period featured increased contact with the Utes and the appearance of more and more trade goods with the opening of the Santa Fe Trail. Much of the contact and interaction in the San Juan and more northerly regions during the Mexican period was related to American fur trading ventures.

In 1833, Navajos were reported to be living among the Weeminuche in the vicinity of the La Plata River and Ute (Datil) Mountain. The Capote band and Navajo relationship had also improved

considerably, much to the dismay of the Mexicans; "New Mexico at the end of the Mexican period was in an unhealthy position on her northern border with Muache Utes depredating south on the east side of the Sangre de Cristos and the Capotes and Navajos raiding into the Rio Arriba area" (Schroeder 1965:64).

The United States took control of the region in 1846 following the war with Mexico. During the next decade, contact with American settlers increased, and the advancing Americans forced the Utes into more isolated regions in Colorado, New Mexico and Utah.

The first treaty between the Utes and the United States was signed at Abiquiu in 1849. This document recognized the sovereignty of the United States and promised $5,000 a year in supplies to the Utes. In the following years this promise was rarely kept. The Utes evidently continued to raid settlements in New Mexico, because in 1855 the governor of New Mexico negotiated the Treaties of Abiquiu with unnamed Colorado Ute bands (Callaway and others 1986:355). This agreement stipulated that Utes were to abandon all of New Mexico except for about 2000 square miles north of the San Juan and east of the Animas Rivers, but the treaty was never ratified.

With the discovery of gold near modern day Denver and Colorado Springs in 1858, there were ever increasing incidents of violence between miners and Utes. The Baker party explored the San Juan country in 1860 and noted mineral deposits on the Animas River near present-day Silverton. By 1863 tensions became so escalated that a treaty council was convened at the Conejos Agency. The United States government intended to convince the Utes to become farmers in the Four Corners region. The Weeminuche and Muache bands did not attend, and although the Capote were present they refused to sign. The only Utes to sign the agreement were from the White River and Uncompahgre groups whose territories were located farther north. By signing, these Utes relinquished their (as well as those of Utes not in attendance) "mineral rights, all mountains settled by whites and the San Luis Valley" (Callaway and others 1986:355).

The Southern Ute bands were served by three subagencies in northern New Mexico: Muache were served at Cimarron, the Capote at Abiquiu, and the Weeminuche at Tierra Amarilla. A larger agency in Taos "continued to keep track of other miscellaneous southern Utes" (Marsh 1982:65).

With waves of destitute Americans flooding the West after the Civil War, a formalized treaty and Reservation was necessary. In 1868, the approximate western third of Colorado was designated Ute Reservation with an agency built at White River (near modern day Meeker). Soon after, the wealth of minerals in the San Juan Mountains was recognized, and Utes were soon relieved of their ownership of the San Juan Mountains under the terms of the Brunot Agreement, or San Juan Cession, of 1874, which deleted much of the central portion of the 1868 Reservation. This isolated the southern portion (approximately the present Southern Ute and Ute Mountain Ute Reservations) from the larger northern portion. Administration of the southern Ute bands was consolidated in 1876 at the Los Pinos Agency on Cochetopa Creek, a tributary of the Uncompahgre River (Delaney 1974).

In 1879, in a dispute over land use, Nathan Meeker, the agent at White River and eight others were killed by Utes. The fallout from this and the Thornburgh Battle in 1880 was the removal of the

northern bands to the Uintah Reservation in Utah. Shortly after 1880, the Los Pinos Agency was moved to its present location near the budding town of Ignacio. Two years earlier all Utes living in New Mexico had been ordered to the Reservation in Colorado and the subagencies in New Mexico were closed (Jefferson and others 1972:24-33; Marsh 1982).

Attempts were also made to remove the southern bands to a Reservation north and east of Pagosa Springs and later to San Juan County, Utah. In 1895 a Ute Indian removal bill was introduced into Congress by Andrew J, Hunter of Illinois. Under his bill, the three southern Ute bands would be located on their old Reservation in the southwest corner of the state and individual allotments of land were to be distributed to Ute families under the terms of the Dawes Severalty Act of 1887. After these and some Tribal lands were allotted, the special status of the Reservation would be removed and the remainder of the Reservation would be opened to white settlement.

This proposal met with a mixed response from the Utes. Most members of the Muache and Capote bands agreed, and a total of 72,811 acres of land were allotted to 371 Utes. However, most of the more conservative Weeminuche band under Ignacio refused to participate and remained at their camp on the drier western end of the Reservation. This land was held as land-in-common for the Weeminuche and a sub-agency was established at Navajo Springs in 1897. This area subsequently became the Ute Mountain Ute Reservation (Delaney 1974; Schroeder 1965:64-72).

Historic Era

The following sections summarize the history of non-Indian, pre-Reservation activities and settlement in the project area, and also the history of Indian and non-Indian activities during the Reservation era.

Pre-Reservation Period

Prior to the establishment of the Reservation, non-Indian use of the project area was by Hispanos from the south and, to a lesser extent, Anglos from the east and north. The Hispano settlers were mostly descendants of the Spanish followers of Don Diego de Vargas who reconquered New Mexico in 1695. Many of these "Espanoles Mexicanos" included members of the Martinez and Serrano families who settled at the New Villa of Santa Cruz de la Cañada below the confluence of the Chama and Rio Grande Rivers (Swadesh 1966:29). Here they irrigated small plots, grazed sheep in the nearby hills and traded with Native American groups along the Old Spanish Trail. This route ran up the Chama River and then down the San Juan River, cutting through the southeast corner of the project area.

Also living among the Spanish were *castas*, people of ethnically mixed ancestry, and *Genizaros*, who included Utes and other American Indians who were enslaved to work as soldiers, farmers, and servants. Compared to many other Tribes in this region, the Spanish developed close ties to the Utes and over the years there was much interaction and intermarriage between these groups. By 1821

when the Mexican Republic was established, approximately 3,000 Spanish and castas and 250 Genizaros were living in the Chama drainage (Swadesh 1966:52).

In the early nineteenth century all good land along the lower Chama River had been allotted by the Spanish, and later Mexican, governments and petitions were made for lands on the upper Chama. One of these, the Tierra Amarilla Grant, awarded in 1832, included lands at the east edge of the project area and, in 1842, the enormous Conejos Grant was made to the east and north. It appears the greatest attraction of these lands was to secure them from possible petitions from outsiders. These areas had been grazed for years, but other than small sheep camps, no permanent settlements were established away from the main rivers. Later, beginning in 1844, hostilities with both the Utes and the Navajos further limited Mexican expansion and in 1846 when the United States territorial period began, many of the Hispano settlers went to live in California or the northern states of Mexico.

During the early territorial period, non-Indian settlement of what was to become SUIR was limited to small Hispano ranchers, many of whom were members of the Cofradia de Nuestro Padre Jesus Nazareno, also know as the Penitente Brotherhood. This movement, which developed during the secular period of the early nineteenth century, was especially popular in the rural areas where there was a shortage of priests (Chavez 1954:110-111). Later, partially because their practice of bodily penance was discouraged by the Catholic Church, the Penitentes sought out isolated localities such as those within the project area. This was a period of increasing hardships and hunger for the Utes and many placed their children in Hispano homes. When grown, these children tended to marry Hispanos or other Utes raised as themselves; their descendants have created a subcultural enclave within the Southern Ute Tribe (Swadesh 1966:89).

Anglo use of the study area came later and was much less intense than that of the Hispanos. As early as the 1820s, mountain men out of Saint Louis trapped the rivers of southwestern Colorado. In 1859 gold was discovered near Denver, and in 1860 was located in the San Juan Mountains. In addition, well organized cattle ranchers began to move in northwest of the study area. These included the notorious Lincoln County "Regulators" as well as groups of Mormons. Unlike the region south of the project area, there were few Hispano property owners in the north (Swadesh 1966:116-1170).

In the early 1870s the local situation began to change very quickly with an influx of highly capitalized Anglo land and livestock enterprises and the "Santa Fe ring" of lawyers and bankers. These men acquired Spanish and Mexican grant lands, usually by illegal means. Later, when the Hispano settlers discovered they were shut out from grazing on their traditional lands, animosities broke out and the "Black Hand," a Hispano guerilla group, was formed. In 1874, the Brunot agreement opened the San Juan area to mining and many Hispanos and Anglos, especially teamsters, settled near access routes to the mountains. In 1876, the Canyon Largo toll road was opened, running across the eastern portion of the project area from the confluence of the Piedra River with the San Juan to the Bloomfield-Canyon Largo area. By this time, although much of the land was controlled by Anglos, the non-native population of the project area was almost entirely Hispanos concentrated in the major river drainages in the southeast portion.

Development of mines north of Durango stimulated development of new transportation corridors. A wagon road was built in the late 1870s from Fort Lewis, west of Durango, down the La Plata River to Farmington. Then, in 1881, the completion of the Denver and Rio Grande narrow-gauge railroad line from Alamosa through Chama to Durango greatly affected the study area. Railroad facilities and small communities of Hispano laborers were founded at Arboles, Allison, Ballejo (later Tiffany), Serano, La Boca, La Boca Station, Ignacio (later Ignacio Station), Oxford, Colina (later Sloan), and Florida. Typically, these railroad towns were rowdy places with saloons and stores. Some of these communities that originally had Spanish names later were redesignated with Anglo names.

Reservation Era

Prior to the allotment of parcels to the Southern Utes, Reservation lands were supposed to be off-limits to non-Indians but some Hispanos settled on Reservation lands (such as at La Piedra near Arboles and at Hinsdale, east of the project area). These Hispanos were forcibly removed in 1883, and Anglo squatters, especially in the northwestern part of the Reservation also were removed (Swadesh 1966:124). General Land Office maps from this era indicate that many ranch buildings were built directly on the southern boundary of the Reservation. This may have allowed non-Indians to efficiently utilize Ute grazing lands without actually making improvements on the Reservation.

In 1886, in an earlier attempt to provide the Utes with farms, lands were cleared and 32 small houses were built for prominent Ute families. This work was performed by Hispanos who then moved into the houses and raised the crops because the Utes were not so inclined (Swadesh 1966:115). This relationship of Hispanos performing labor for the Reservation continued to recent times. Many Hispano families moved close to the agency, or near allotment farms to dig irrigation ditches or herd Indian livestock on the more isolated portions of the Reservation. Navajos also occasionally were hired by the Indian agent to dig ditches for the farms (Delaney 1974:53).

Of the Indian allotments, most were quarter sections located on the well-watered bottom lands of the Pine River and to a lesser extent along the Animas, Florida and La Plata rivers and on Spring Creek. Since the individuals obtaining the allotments had little experience with irrigation, it is not known what criteria were used for choosing these lands and in what order allotments were selected. By 1910 approximately one hundred Ute families were farming 6,500 acres of alfalfa and oats, as well as grazing cattle, and some sheep and horses (Jefferson and others 1972:47). Some allotments were leased to Anglo ranchers and, after 1910, the allotments of deceased Utes could be sold to non-Indians, with the agreement of the heirs.

The allotment system tended to disperse the Utes living on the Reservation although many continued to live near the agency and several smaller communities. A few of these communities had strong Hispano influences and in later years some Ute descendants were dropped from Tribal rolls due to diminished Ute relatedness (Swadesh 1966:112). During this period Ute leadership remained remarkably stable. Buckskin Charlie assumed leadership of the Southern Utes in 1880 upon the death of Ouray, who had been the principal leader of the Utes since the 1860s. Buckskin Charlie led the southern Ute bands for 56 years until his death in 1936 when his son, Antonio Buck, Sr., was

installed as the last hereditary chief of the Southern Utes and then elected the first Tribal chairman under the new Tribal constitution.

Homesteading

After the 1895-96 allotment of Southern Ute lands, more than one-half million acres in "surplus" lands were opened to non-Indian homesteaders. At first, claims were filed under the Homestead Act of 1862, which enabled heads of households to file for 80 acres of land adjacent to railroad grants or 160 acres of land elsewhere (Gates 1968:394). The act also required that the lands be non-saline, non-mineral, not used for business, not withdrawn for townsite, nor reserved by the Federal government for other uses. A total of 2,070 entrymen made homestead claims within the project area under the 1862 Homestead Act (Table 4). Government lands also were available for purchase as Cash Entries for $1.25 or $2.50 per acre, and 447 parcels were acquired through cash entries. In a predictable pattern, many of the early homestead entries were claimed near the main drainages where irrigation was possible.

While the land was nominally free to homesteaders, they were required to pay filing fees, cultivate the land, build a residence, and live there for five years. If a homesteader failed to meet the legislated requirements, he could relinquish the claim and refile elsewhere. Otherwise the government would cancel the entry. Relinquishment of a claim, rather than allowing it to be canceled, is often a good indicator of the entryman's commitment to homesteading. Only about 43 percent (896 of the 2,070) of the filed homestead entries were successfully patented (Figure 15). Most of the early failures were formally relinquished suggesting those homesteaders planned to try somewhere else, but after about 1910, most failed homesteads were canceled by the government.

In many parts of the semi-arid West, 160 acres was far too little land for a viable farm or ranch. In an attempt to remedy this problem, Congress passed the Desert Land Act of 1877. Under this law, an entryman could file on as many as 320 acres, but these had to lie in a compact form, be feasible for irrigation purposes, and be irrigated following a pre-approved plan (43 CFR Part 2520.0-1). Residency was not required but extensive improvements in the form of dams, canals and storage reservoirs were. In addition, the entryman had to prove that he actually irrigated and reclaimed at least one-eighth of the acreage of his claim. A total of 387 desert land entries were made within the project area, but only 38 or about 10percent were actually patented, mostly in the river bottoms. Desert land entries were probably less successful because most individual farmers found it impractical to construct irrigation systems or to obtain water rights. At the same time, desert land entries were too small and often too dispersed for capitalists to make money selling water to them (Stathis 1979:188).

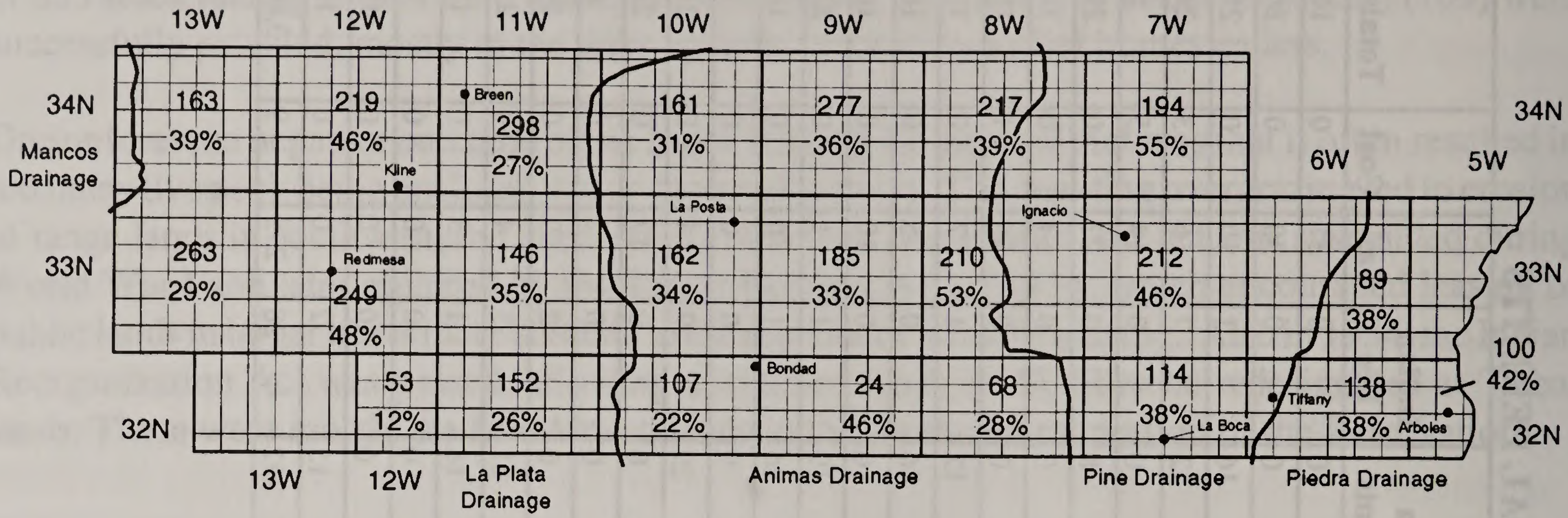
The Homestead and Desert Land acts still left much desert scrub land in the public sector. The Stock Raising Homestead Act of 1916 was passed to encourage settlement of these areas. Homesteads of up to 640 acres could be claimed under this act, but the entryman had to make improvements on the land that would aid in stock raising and represented a minimum investment of $1.25 per acre. Mineral and coal rights, watering places, and access ways were reserved by the government. A total

of 353 stock raising entries were made within the study area, but only about 30 percent (109) were successfully patented, mostly in the drier uplands ignored by earlier homesteaders.

One unforeseen negative outcome of the Stock Raising Homestead Act was that it often resulted in too many livestock being enclosed within too small an area. The resulting overgrazing led to erosion of range lands in southwestern Colorado as elsewhere. As a result, the act was suspended during World War I and later replaced by the Taylor Grazing Act of 1934, which encouraged leasing of public lands in larger tracts more suitable to the realities of western grazing. Also in 1934, the Indian Reorganization Act was passed, allowing unclaimed lands on SUIR to be redesignated as Tribal lands. These were mostly the less desired lands in the south-central portion of the Reservation.

TABLE 4
SUMMARY OF HOMESTEADS, ALLOTMENTS, AND OIL, GAS, AND COAL PERMITS

	Homestead Act		Desert Land Act		Stock Raising Act		Subtotals			Cash	Indian	Indian			
Township	Entries	Patents	Entries	Patents	Entries	Patents	Entries	Patents	Success	Entries	Allotments	Fee	Gas	Coal	Totals
34N 13W	118	45	0	0	11	5	129.00	50.00	0.39	3	0	0	31	0	163
33N 13W	192	56	20	2	20	9	232.00	67.00	0.29	1	0	0	30	0	263
34N 12W	143	69	19	2	5	5	167.00	76.00	0.46	25	16	1	10	0	219
33N 12W	140	74	31	4	3	5	174.00	83.00	0.48	47	12	7	6	3	249
32N 12w	9	0	2	0	23	4	34.00	4.00	0.12	0	0	0	14	5	53
34N 11W	145	42	59	9	26	10	230.00	61.00	0.27	33	8	0	27	0	298
33N 11W	48	21	3	3	37	7	88.00	31.00	0.35	4	0	0	54	0	146
32N 11W	70	19	13	0	32	11	115.00	30.00	0.26	0	0	0	36	1	152
34N 10W	86	30	1	0	38	9	125.00	39.00	0.31	16	12	1	7	0	161
33N 10W	105	42	13	0	19	5	137.00	47.00	0.34	4	16	0	5	0	162
32N 10w	58	18	2	0	35	3	95.00	21.00	0.22	2	0	0	10	0	107
34N 9 W	157	69	51	6	1	1	209.00	76.00	0.36	47	19	1	1	0	277
33N 9W	119	41	16	2	11	5	146.00	48.00	0.33	12	26	1	0	0	185
32N 9W	17	8	0	0	7	3	24.00	11.00	0.46	0	0	0	0	0	24
34N 8W	94	46	23	0	5	1	122.00	47.00	0.39	53	29	9	4	0	217
33N 8W	149	81	10	2	24	14	183.00	97.00	0.53	10	0	0	17	0	210
32N 8W	28	10	0	0	30	6	58.00	16.00	0.28	3	0	0	7	0	68
34N 7W	99	61	14	3	9	3	122.00	67.00	0.55	61	0	2	9	0	194
33N 7W	109	57	18	0	2	2	129.00	59.00	0.46	15	61	3	4	0	212
32N 7W	42	27	31	2	6	1	79.00	30.00	0.38	13	18	1	3	0	114
33N 6W	60	26	9	1	3	0	72.00	27.00	0.38	17	0	0	0	0	89
32N 6W	38	27	34	1	1	0	73.00	28.00	0.38	65	0	0	0	0	138
32N 5W	44	27	18	1	5	0	67.00	28.00	0.42	16	15	2	0	0	100
Totals	2,070	896	387	38	353	109	2,810.00	1,043.00	0.37	447	232	28	275	9	3,801



number of homestead entries; Indian allotments; oil, gas, and coal permits
##% success of homesteading efforts

Figure 15 Homestead Entries; Indian Allotments; Oil, Gas, and Coal Permits

Community, Irrigation, and Transportation Developments

During the homesteading period, several small communities developed, especially in the mostly Anglo western part of the Reservation. These include Redmesa, Kline, Breen and Bondad. Surprisingly, even in the predominantly Hispano southeastern portion of the Reservation, few homesteads were successfully patented by Hispanos. By 1915 only five out of 363 homesteads had owners with Spanish surnames, and these were mostly around Tiffany. After the turn of the century, Hispanos continued to play an important, if waning, role on the Reservation. The community of La Posta included many Hispanos, and Ignacio was mostly settled by Hispanos after it was platted in 1910. Store owners and saloon keepers in Ignacio, such as Fabian Martinez, were locally important men. One point of contention was between the usually Anglo Indian agents at Ignacio and the Hispanos who performed many of the labors and services on the Reservation. Many agents resented the close relationship between the Utes and the Hispanos and attempted to replace the latter with men of their own choosing. The tendency of many Hispanos to run stills in the isolated canyons and bootleg illicit liquor to the Utes did nothing to endear them to the government men (Swadesh 1966:125).

Ignacio itself is a bit confusing as there are four separate locations with this name. First, in 1877 was the Los Pinos Agency, which later became known as the Ignacio Agency. In 1881, Ignacio Station was established two and one half miles to the south on the new Denver & Rio Grande Railroad. In 1910 the present residential center of Ignacio was established between the two and incorporated in 1913. A 1915 map indicates a location for "Ignacio City" located in Section 1, T33N, R8W, some one to two miles northwest of Ignacio. This last location may have been a proposed townsite, and it is not known if anything is presently there.

In 1902, the Secretary of the Interior permitted rights-of-way through allotted lands for irrigation ditches to serve homesteaders provided the Southern Utes consented (Jefferson and others 1972:47). Soon after, several privately-financed ditch and reservoir complexes were constructed. These included the Bent and La Plata (Pruitt) ditches on the La Plata River, the Animas Mesa Ditch on the Animas River, and the Colorado Land and Water Co., Ignacio Mesa, Thompson Eperson Extension, and Pine River Ditches on the Pine River. In addition, several other ditches were built by the Indian Service.

During the homesteading period, transportation continued to improve, with roads connecting Ignacio with both Durango and Arboles. Many smaller roads were established to access isolated homesteads and grazing areas. During this period the Denver & Rio Grande Railroad also built a line down the Animas Valley connecting Durango and Farmington, and in 1905 the Arizona & Colorado Railroad planned, but never built, a line down the La Plata Valley.

Mineral exploration expanded in the mid-1920s. Oil and gas prospecting was pursued across much of the western portion of SUIR, and coal was mined in the vicinity of the Cinder Buttes. Some placer mining also occurred within the project area along the lower Piedra River. Sawmills were established on the well-forested uplands and timber was hauled to sidings along the railroads.

SENSITIVITY MODELING

Because a complete inventory of cultural resources has not been compiled, "sensitivities" were modeled for the project area. High, moderate, and low sensitivity zones were defined for archaeological sites reflecting native occupation during the prehistoric and ethnohistoric eras, as well as for archaeological and historical sites dating from the historic era. The defined sensitivity zones were intended to reflect relative density and complexity of cultural resources. The methods used to develop these models and the results are described in the following sections.

Methods

Modeling human use of a landscape over thousands of years, and then predicting what evidence of those occupations survives is a daunting challenge. In some situations, archaeologists have been able to develop quantitative models to predict the distribution of archaeological sites, using sets of variables such as soil type, natural vegetation, elevation, aspect, slope, distance to water, and other variables (Grady 1980). However, development of such models typically requires extensive survey data to develop empirical correlations with various environmental parameters, and such models do not necessarily enhance our understanding of the those settlement patterns.

As discussed above, archaeologists have identified patterns of where different types of archaeological sites tend to be located (such as, Pleistocene terraces, valley floors, ridges, etc.), and how site locations have changed over time. More formal predictive modeling sometimes has demonstrated that such commonly held intuitive characterizations of site placement are not always good predictors of site locations (Adams 1975; Grady 1980; Hibbets and others 1979). The available data for SUIR does not provide a basis for a rigorous quantitative model, and therefore we have worked with the more intuitive prior observations of settlement patterns and cautiously used them to define sensitivity zones.

The basic unit of study for this analysis is the site. Isolated artifacts or occurrences were not considered because (1) regulatory and land managing agencies consider almost all isolated finds to be insignificant resources, (2) their inconsistent recording over the years and often seemingly fortuitous distributions skew settlement data, and (3) current Southern Ute Tribal policy stipulates that isolated finds not be recorded. Sites were classified as either architectural or non-architectural within temporal and cultural units. Characterization as architectural or non-architectural provides information about seasonal use versus permanent occupation, and architectural sites typically would require more substantial mitigation efforts if they were to be adversely affected.

Projecting site densities from the available survey data is problematic for several reasons. One problem stems from inconsistency in site survey and recording practices, which have become more intensive, especially over the last 10 to 20 years. Many smaller sites were not detected by earlier surveys. Some types of sites, such as simple artifact scatters or features, that 20 to 40 years age would have received only passing mention are now viewed as more meaningful resources and routinely designated as sites. Also, the amount of information recorded about sites has tended to

increase over time, and usually less is known about sites recorded years ago than those recorded more recently. Accordingly, more recent surveys conducted throughout the region usually report higher site densities than earlier surveys.

Site visibility is another problem. Large areas in the project area where no sites have been recorded are under cultivation or are highly altered in other ways. We suspect that the absence of reported sites reflects alteration of the ground surface rather than a lack of archaeological sites.

Another major problem stems from the Southern Ute Tribal policy concerning avoidance of archaeological sites. Although this policy has resulted in commendable preservation of sites in place, those sites that are avoided by margins of some 50 to 100 feet routinely are not recorded or reported. As a result, a considerable number of acres of Tribal lands have been surveyed, but reported densities of archaeological sites are low and do not represent actual densities and patterns of site distribution. Surveys on non-Tribal lands within SUIR show higher densities that present more accurate information, but the extent of surveys in these areas is not great.

In sum, the recorded patterns of site density must be interpreted cautiously. In fact, the patterns are likely to reflect the degree of prior survey as much as any variation in the actual distribution of sites.

Predicting the potential for historic resources is somewhat easier than for prehistoric resources because so much of historic land use is documented. Exceptions include illegal activities such as squatting or prospecting on the Reservation by non-Indians, the construction of stills and other bootlegging activities, and temporary herding facilities.

Other activities are often well documented. All claimed and patented homestead locations are listed in the records of the General Land Office maintained by the BLM. Those records also list the locations and dates of Indian allotments, cash entries, oil and gas exploration permits, coal leases, mining claim patents, and ditch, reservoir, road, railroad, and pipeline rights-of-way. The General Land Office surveyed township maps are also useful because they show the as-built locations of cultural features such as roads, ditches, communities and ranches. The maps are limited in that they depict only what was built at the time the surveys were made. For most of the study area, these maps were made between 1881 and 1886. Other maps utilized for this project include historic military maps, land and water company maps, BLM surface management status maps (scale = 1:100,000), county maps (scale = 1:50,000), and USGS topographic quadrangles (scale = 1:24,000).

The following sections discuss trends in the distribution of recorded archaeological sites for each defined cultural and temporal period.

Distribution of Archaeological Site Components Within Drainages

Within the boundaries of SUIR west of the Piedra River, 967 sites have been recorded. They range in time from the early Archaic period to historic manifestations less than a century old. Those sites occupied by more than one cultural group or subgroup during different periods are considered to be multi-component. A total of 1,040 components are represented by the 967 sites within the study area (and because the temporal and cultural groupings used are actually quite gross, the actual number of occupational episodes is likely much greater than the tabulated 1,040 components).

The project area is cut by four south flowing rivers tributary to the San Juan River. The drainage basins of these rivers are not only convenient geographical divisions for evaluating settlement patterns, but often appear to reflect prehistoric cultural boundaries (Eddy and others 1984). Therefore, we tabulated site components by the four drainage units: La Plata, Animas-Florida, Pine, and West Piedra (Table 5). These basins are the same subdivisions used by Eddy and others (1984) in their analysis of southwestern Colorado prehistory, and the information compiled here augment that study with both comparable and contrasting data.

The density of recorded sites within sections (usually one square mile but some sections are irregular) is displayed on Figure 16. Several observations are evident.

First, over 60 percent of the sections in the SUIR area have no previously recorded sites in them. Many of these cluster in areas that are presently agricultural fields, some of them being farmed for over a century. Others, however, are on Tribally owned land in close proximity to areas known to have been densely settled in prehistoric times, such as the lower La Plata Valley, Mancos Canyon, and Mesa Verde. Simply stated, we do not know what archaeological sites are in those sections, but almost certainly numerous unrecorded sites are present.

Second, there is an apparent increase in site density from east to west across the project area with marked concentrations south of Durango and along the La Plata River just north of the New Mexico border. Oil and gas fields, utility corridors, and features of the proposed Animas-La Plata water project are located in these areas, and all have been subject to substantial intensive archaeological survey. Although the available survey information indicates these areas have relatively high site densities, they may not actually be substantially higher site concentrations than in surrounding areas that have not been subject to as much intensive survey.

TABLE 5
RECORDED SITE TYPES AND CULTURAL COMPONENTS WITHIN DRAINAGES

	La Plata		Animas-Florida		Pine		West Piedra		Totals		
Culture Period	**NA**	**A**	**NA**	**A**	**NA**	**A**	**NA**	**A**	**NA**	**A**	**All**
Archaic	28		6		1				35		**35**
Anasazi											
BMII	1	5	9	5	4	7	1	2	15	19	**34**
BMIII-PI	58	60	35	85	22	30	25	42	140	217	**357**
PII-PIII	34	64	14	6	5	3	3	5	56	78	**134**
PIV	5		2				2		9		**9**
Unknown Anasazi	20		10	2	14	4			44	6	**50**
Subtotals	118	129	70	98	45	44	31	49	264	320	**584**
Navajo											
Dinetah			1	1					1	1	**2**
Gobernador	17	7	5	4	2	2	2	1	26	14	**40**
Unknown Navajo	8		20	5	1	1	1		30	6	**36**
Subtotals	25	7	26	10	3	3	3	1	57	21	**78**
Ute	5		2		2				9		**9**
Euro-American	23	24	7	14	6	11	2	2	38	51	**89***
Unknown	136		65		29		13	2	243	2	**245**
Totals	**335**	**160**	**176**	**122**	**86**	**58**	**49**	**54**	**646**	**394**	**1,040**

A = architectural; NA = non-architectural
* some imprecision due to vague site descriptions; some separate site designations combined, such as parts of Denver and Rio Grande Railroad grade and BIA buildings in Ignacio Agency complex

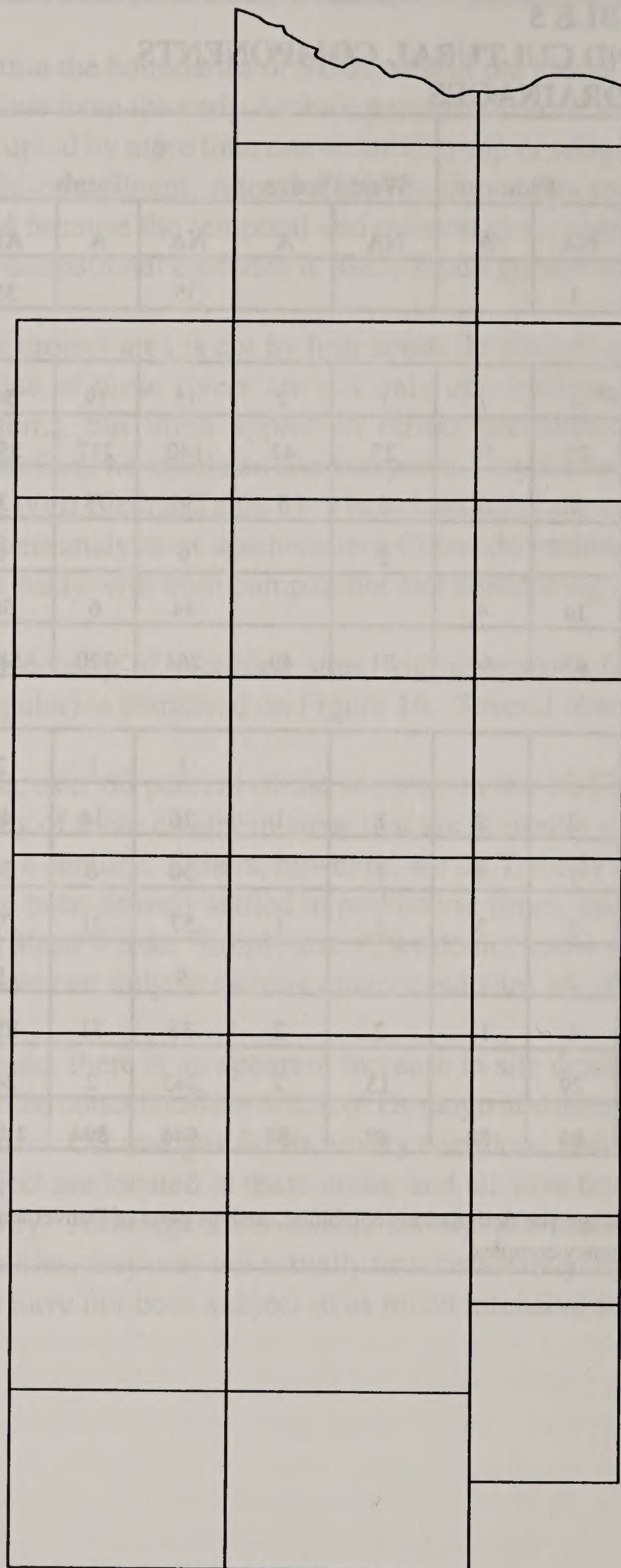


Figure 16 Density of Recorded Archaeological Sites in the Project Area

Third, areas south of Durango that have been intensively surveyed within SUIR reflect site densities in excess of 25 sites per square mile, as do areas on the lower La Plata River. Given that both of these areas are located adjacent to primary water courses, and considering the statements of Reagan (1919) and Roberts (1925) who conducted broad, extensive surveys in the region, it is reasonable to assume that the entire courses of the four principal rivers in the project area contain archaeological sites in high densities. Secondary drainage courses will probably reflect complimentary and only slightly lower densities. However, high site densities can also be expected in some upland areas beyond the river valleys. As previously discussed, evidence from Navajo Reservoir (Eddy 1972) and adjacent areas further up the San Juan River (Adams 1975) and Piedra River valleys (Eddy 1977) indicate that from the Rosa phase onward archaeological sites were commonly located in upland areas as well as in the river valleys. Wilshusen's (1995) recent work just to the south of SUIR has shown some of the highest site densities in the region (about 45 sites per square mile) are in secondary, intermittent drainage basins well away from the major rivers.

The following paragraphs briefly describe the distribution of the 1,040 recorded site components by drainage unit. The data reflect shifting centers of occupation and utilization for each of the five cultural traditions recognized in the project area.

Oshara Tradition

The majority of the records for pre-Formative sites ascribe only a generalized Archaic affiliation without further chronological precision. Therefore, finer phase or subperiod patterns for the Oshara Tradition cannot be evaluated.

A total of 35 site components are assigned to the Oshara Tradition. The majority of Oshara site components (28, or 80 percent) lie in the La Plata unit, with six components (17 percent) in the Animas-Florida unit. None are recorded in the western Piedra drainage basin that is within the study area, and only a single component has been recorded within the Pine River basin. Because the sample is so small, the near absence of Oshara components in the eastern half of the project area may not be a meaningful pattern, especially in consideration of the fact that Archaic sites are known from adjacent areas to the north in the HD Mountains (Martorano and others 1985).

Given the modest representation in the Animas-Florida unit and the dominance displayed in the La Plata unit some speculation is offered. Both drainage units lie considerably closer to high altitude alpine and subalpine environments than do their eastern counterparts. Because the Oshara Tradition reflects a broad spectrum hunting and foraging Archaic adaptation, the presence of more life zones in shorter linear distances may help account for the site distributions. Moreover, the La Plata Valley may well have served as a corridor of sorts between the low-lying San Juan River Valley and the La Plata Mountains. In its short course of 45 miles, the La Plata River traverses all life zones present on the Colorado Plateau—a virtual storehouse of resources for hunters and gatherers.

Anasazi Tradition

Site components dating to the Anasazi period account for 56 percent (584 components) of the recorded inventory within the project area. All Anasazi subperiods are represented in the survey records, but in varying frequencies from east to west. The data suggest shifting centers of population through time, a pattern common to prehistoric Puebloans across the northern Southwest. The distribution of Anasazi components among the drainage units is plotted in Figure 17.

Basketmaker II

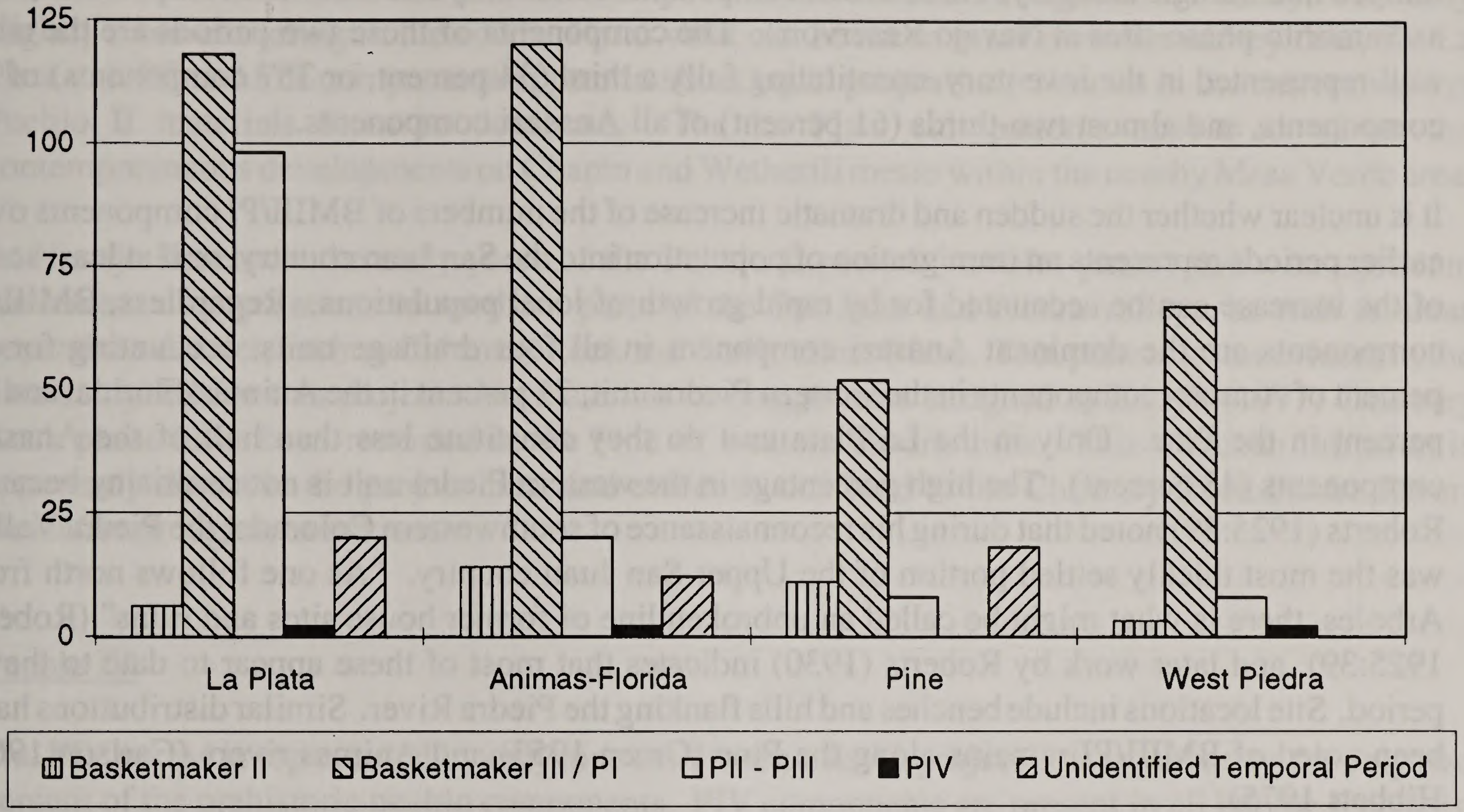
Preceramic BMII components are present in all drainage units and account for 6 percent (34 components) of all Anasazi components. The Pine drainage unit contains the largest number, followed by the Animas-Florida and Piedra drainages. In contrast to the La Plata drainage dominance of the preceding Oshara Tradition, the La Plata unit contains the fewest BMII components. It is noteworthy that the La Plata unit lies within two miles of Mesa Verde National Park, and no BMII sites have been found within the park boundaries.

The Animas-Florida and Pine valleys are well known for their Basketmaker remains, and excavations north of Durango (Morris and Burgh 1954) and on the Pine River in New Mexico (Eddy and Dickey 1961) form the basis of definition of the BMII period in the northern San Juan Basin. So many sites have been reported (though not necessarily recorded) in the Pine River Valley that Eddy and others (1984) consider the middle and upper Pine Valley to be a core area for Los Pinos phase (BMII) culture in the upper San Juan region. Eddy and others (1984:76), citing avocational archaeologist Betty Green, note concentrations of Los Pinos remains flanking the Pine River from the site of La Boca northward to Vallecito Lake.

BMII components can be expected, quite possibly in high numbers, along the entire course of the Pine River in the project area. Modern agricultural practices and rapidly developing subdivisions and ranchettes are probably masking and destroying these sites.

Figure 17

Distribution of Anasazi Components Within Drainages



Basketmaker III/Pueblo I

Distinguishing BMIII sites from PI sites on the basis of surface indications is difficult, so they are lumped into a single category. Also, BMIII components commonly underlie later components (such as Sambrito phase sites at Navajo Reservoir). The components of these two periods are the most well represented in the inventory, constituting fully a third (34 percent, or 357 components) of all components, and almost two-thirds (61 percent) of all Anasazi components.

It is unclear whether the sudden and dramatic increase of the numbers of BMIII/PI components over earlier periods represents an immigration of population into the San Juan country, or if at least some of the increase can be accounted for by rapid growth of local populations. Regardless, BMIII/PI components are the dominant Anasazi component in all four drainage units, accounting for 84 percent of Anasazi components in the western Piedra unit, 71 percent in the Animas-Florida, and 58 percent in the Pine. Only in the La Plata unit do they constitute less than half of the Anasazi components (48 percent). The high percentage in the western Piedra unit is not surprising because Roberts (1925:39) noted that during his reconnaissance of southwestern Colorado, the Piedra Valley was the most thickly settled portion of the Upper San Juan country. "As one follows north from Arboles, there is what might be called an unbroken line of former house sites and ruins" (Roberts 1925:39), and later work by Roberts (1930) indicates that most of these appear to date to the PI period. Site locations include benches and hills flanking the Piedra River. Similar distributions have been noted of BMIII/PI remains along the Pine (Green 1953) and Animas rivers (Carlson 1963; Hibbets 1975).

Demographic shifts between drainage units may have occurred during this phase. Gooding (1980) convincingly argues that much of the middle and upper Animas Valley was abandoned by the end of the eighth century probably because of a very localized drought. Conversely, areas near the Animas show marked increases in population in the following century, notably the Piedra Valley, the Navajo Reservoir district, and Mesa Verde. The apparent sparse settlement of the La Plata unit in the preceding BMII period followed by relatively dense settlement in the BMIII/PI period demonstrates a real need for a refinement of survey methodology and site excavation and dating in order to understand prehistoric demographic changes in the sixth through ninth centuries.

Pueblo II/III

The latter half of the Anasazi sequence has also been grouped to compensate for inconsistent survey data. In the more well-known Anasazi regions, such as Chaco Canyon and Mesa Verde, the PII/PIII periods witness major increases in the numbers and types of archaeological sites present, culminating with the Great or Classic Pueblo period. In contrast, the number of site components decline sharply during the PII/III periods within the project area, with the exception of the La Plata drainage.

The PII/III periods account for 134 site components in the project area; nearly three-fourths of these concentrate in the La Plata unit with the remainder in the eastern valleys. The few PII/III

components in all the eastern valleys are located in the southern sections near the New Mexico state line.

In the La Plata unit these late Anasazi components are located throughout the valley, with only slightly more clustering in the south. From what can be ascertained from the survey data, the La Plata unit PII and PIII components appear in about equal proportion, whereas in the eastern valleys Pueblo II materials seem to dominate. The La Plata unit patterns appear to mirror the contemporaneous developments on Chapin and Wetherill mesas within the nearby Mesa Verde area.

At Navajo Reservoir the early years of the Pueblo II period (Arboles phase) show an upstream movement of populations to northern parts of the San Juan and Piedra valleys, as well as areas beyond the district, such as Chimney Rock and Stollsteimer Mesa. This pattern is not evident in the data compiled for this project. No materials or components assigned to Eddy's (1977) Chimney Rock phase have been recorded in the Pine or western Piedra units. This Chacoan intrusion is apparently absent in the project area, and evidently confined to the Chimney Rock-Piedra River-Devil Creek region to the north.

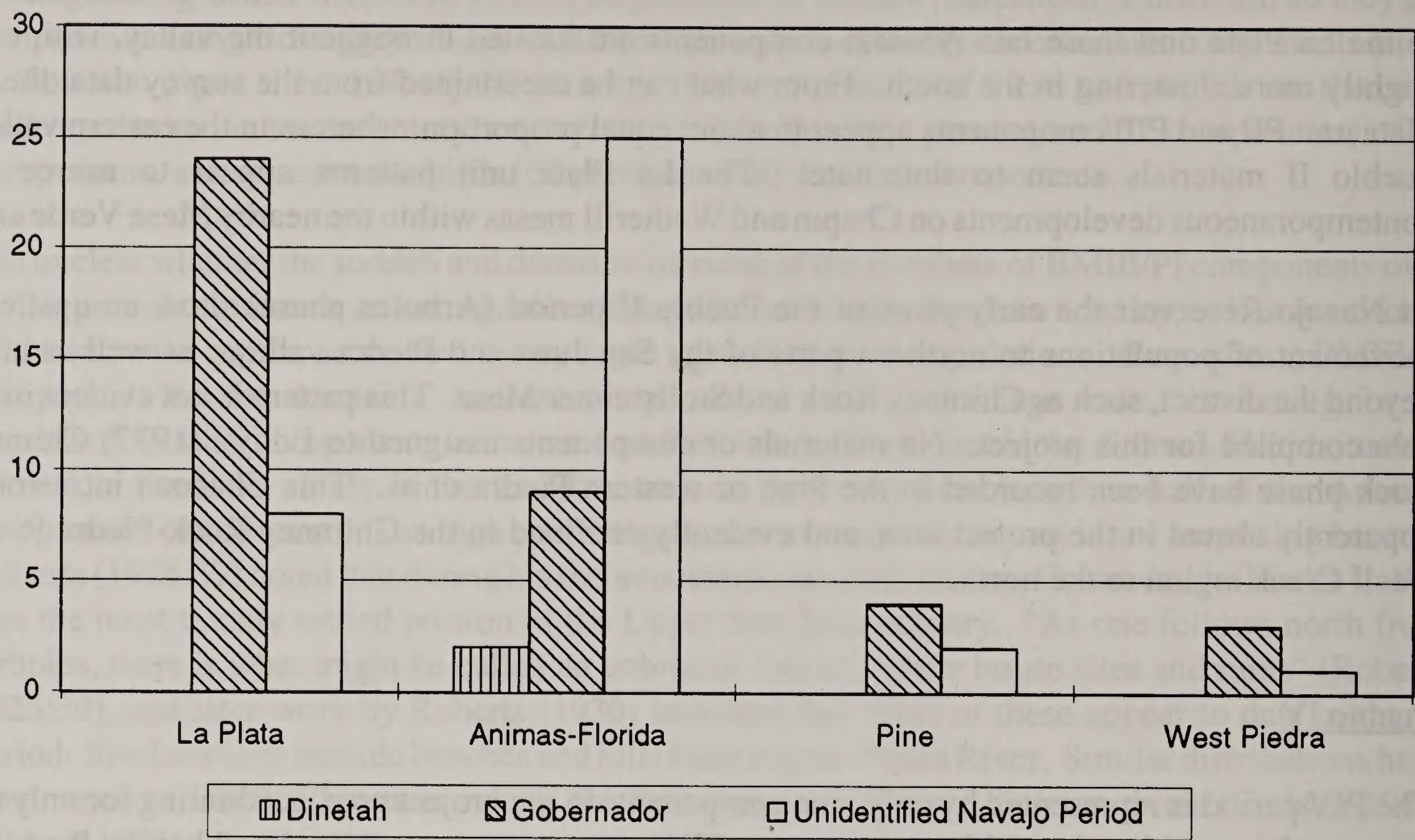
Pueblo IV

The PIV period is represented by only nine components in the project area, accounting for only two percent of the prehistoric pueblo components. PIV components are present in all but the Pine unit, with most in the La Plata valley (five components). No PIV materials were found on architectural sites, which indicates Puebloan use of the project area during the fourteenth to early sixteenth centuries was ephemeral at most. In fact, the PIV ceramics that identify these components may have been carried into the region by the Ute or Navajo as trade wares.

Navajo Tradition

Navajo use and occupation of the project area is recognized in 78 site components (7.5 percent of recorded components). Navajo remains are present in all drainage units, but concentrate in the Animas and La Plata valleys (Figure 18). Only two recorded components are assigned to the early Navajo Dinetah period; both are located in the Animas-Florida drainage. The subsequent Gobernador phase accounts for more than half (51 percent) of all identified Navajo components. Gobernador remains are found in all drainage units, but concentrate in the La Plata Valley where more than half of them are located. Within the La Plata drainage, most of these Navajo components cluster near the New Mexico state line in upland areas east of the La Plata River. There is a marked decrease in Gobernador components from west to east.

Figure 18
Distribution of Navajo Components Within Drainages



The Navajo components labeled as "unknown" have not been assigned to any specific subperiod. These unassigned components are found in all drainage units, but are quite sparse towards the east. Twenty-five of the 36 unknown Navajo components cluster rather tightly in the Animas drainage, mostly west of the Animas River just north of the state line.

The Animas-Florida drainage unit has more Navajo affiliated remains than the other units, but the La Plata is a close second. The west Piedra drainage has the fewest Navajo components. More than three-fourths of all Navajo remains cluster in the Black Ridge-Long Mountain area, which forms the divide between the Animas and La Plata drainages. Gobernador remains are most common on the La Plata side, and temporally unassigned Navajo components are more common on the east.

Ute Tradition

Considering that the project area encompasses three-fourths of SUIR, it seems odd that less than one percent of the recorded site components can be assigned to Ute culture. Some 25 years ago, Buckles (1971) recognized that Ute sites often are archaeologically unrecognizable unless diagnostics such as European trade goods, wickiups, horse remains, Ute manufactured pottery, or rock art depicting historic items or events, are present, and such diagnostics are rare in the archaeological record.

In 1919 Reagan (1919:173) noted that shortly after the establishment of the Los Pinos Agency, Utes established a village atop Anasazi ruins in what is now the west edge of the town of Ignacio, "also making their graveyard on the ancient ruins...it is hard to tell what is Ute and what is ancient debris." In 1923 Roberts noted teepee poles, berms, and glass beads in and among Pueblo ruins at Stollsteimer Mesa on the Piedra River (Roberts 1925:41). As mentioned above, a seventeenth-century Ute structure with artifacts was recognized at the BMII Talus Slope Village, just north of Durango (Dean 1975).

These references indicate that sometimes Utes selected former Puebloan sites for their village or camping locales, creating a confusing archaeological record.

In the late 1970s, Jeffery T. Wharton (personal communication, 16 July 1996) directed a small excavation at a wickiup-like site south of Durango and one-half mile north of the project area. Wharton has considerable experience with both Ute and early Navajo remains throughout the Four Corners region, and concluded that this site (5 LP 353) probably was constructed by the Ute, even though the ceramics recovered from the site probably were made by Navajos. No wood was suitable for tree ring dating, but a piñon pine tree was growing within a structure at the site and yielded a pith date of 1802. The site only has been briefly described in an unpublished paper (Heikes 1979).

Schroeder (1965:169) notes that in 1859 a Navajo band under the leadership of Cayetano was living in the La Plata Valley and Capote Utes were living on the Animas River. Interaction between these groups could easily blur the archaeological record. These examples suggest that the presence of Utes often may be represented in the archaeological record in mixed deposits. How many of the inventoried sites identified as "unknown Navajo" might, in fact, be like site 5 LP 353?

Only nine sites with Ute components have been recorded within the project area. No Ute sites have been recorded in the west Piedra unit. The two Ute site components in the Pine drainage are both historic. Two other Ute components have been identified in the Animas drainage, and five in the La Plata. Although there is abundant historical documentation to place the Utes throughout the project area, the archaeological data clearly are too meager to meaningfully discuss any patterning in the distribution of Ute sites.

Unknown Aboriginal Cultural Affiliation

About one-fourth (24 percent) of the site components cannot be assigned to any cultural period. These 245 components are usually scatters of lithic debris or isolated features lacking datable objects or distinctive types of features. They are present in all drainage units and increase in numbers from east to west. In the west Piedra drainage, 15 percent of the recorded site components are of unknown affiliations, and the frequency is nearly doubled in the La Plata drainage (28 percent).

While no statistical manipulations have been attempted, there is some correlation between areas with high numbers of sites of unknown cultural affiliation with areas having high frequencies of Archaic and Navajo period sites. Detailed analyses of lithic remains at Navajo, Archaic, and unknown period sites in the La Plata Valley may clarify this matter.

Euro-American Tradition

Components dating to the historic Euroamerican occupation of the project area are present in each of the drainage units. Segments of some linear features such as railroad grades have been recorded as separate sites, and numerous individual buildings that all are part of the old Los Pinos Agency in Ignacio have been recorded as individual resources rather than as a site. After combining these, 89 historic Euro-American components were tallied, accounting for 9 percent of the total.

Somewhat more than half of the Euro-American components are located in the La Plata drainage. These are almost equally divided among architectural and non-architectural sites. The architectural sites are variously characterized as foundations, dugouts, structures, cabins, houses, shelters, homesteads, farms, or shelters. Most of these probably reflect residences associated with agricultural uses. A kiln and a sawmill are the only architectural sites identified with more specific functions. The non-architectural sites are mostly characterized as camps or trash deposits, with cairns, rock art, and a corral being more specifically identified features.

Approximately one-fourth of the Euro-American components have been identified in the Animas drainage. Two-thirds of these are classified as architectural and are characterized similarly to the residential sites identified in the La Plata drainage. More functionally specific sites include a church and a sawmill. The non-architectural sites include sites identified as railroads and a windmill, along with the more typical trash deposits and a camp.

Almost one-fifth of the Euro-American components are located in the Pine River drainage. Almost two-thirds of these are architectural and include the typical residential sites along with a commercial building and various types of BIA buildings at the Lost Pinos Agency at Ignacio. The non-architectural sites are all characterized as trash deposits, except for a single cemetery.

Only four Euro-American components are recorded in the west Piedra drainage. They include two architectural sites, labeled as an adobe and a jacal, perhaps a reflection of the intensive Hispanic influence in the occupation of this area. The non-architectural sites include a trash deposit, and the National Register listed Del Rio Bridge discussed above as a special status cultural resource.

The density of recorded Euro-American components decrease from west to east. This probably reflects levels of survey more than actual variation in the density of Euro-American use of the landscape. The majority of the recorded components seem to reflect habitations associated with agricultural. It is impossible to tell how many of these might reflect original homesteading activities, and some of these site may represent occupations on Indian allotments. Many of the non-architectural sites may very well be related to ranching and farming activities as well.

In addition to the recorded historic components, an inventory of historic localities and features was compiled from historic records and maps (see Maps CR-2 and CR-3). This inventory primarily reflects the distribution of homesteads and allotments, developed communities, transportation corridors, and irrigation systems. Historic oil and gas activity, coal mining, and cemeteries also were identified. Although few of these resources have been formally recorded, they do indicate the relative intensity of historic occupation. Physical remnants of at least some of these activities are likely to remain intact.

Summary of Site Component Distribution Patterns

The 1,040 cultural components recognized at the 967 sites present in the project area reflect human occupation spanning all cultural periods back to the Early Archaic period. No components dating to the Paleo-Indian tradition have been identified in the project area nor the remainder of SUIR, but have been documented in adjacent areas of San Juan National Forest. The distribution of site components reflect shifting centers of population through time. The Anasazi Tradition is represented by the number of components (584 cases) and accounts for 56 percent of the inventory in the project area. Smaller numbers of Navajo, Ute, Archaic, and Euro-American components are represented. Almost one-fourth of the components cannot be assigned to any cultural period.

In numbers, the La Plata drainage unit contains the largest concentration of components (495 or 48 percent), and includes ample evidence of all temporal units except the questionable appearance of early Navajo (Dinetah) remains. This is surprising because adjacent areas of the La Plata Valley in New Mexico contain numerous Dinetah phase sites (Winter and Hogan 1992). The number of components progressively decreases to the east. However, this distribution probably reflects the amount of prior survey rather than the actual distribution of archaeological and historical sites. Oil and gas exploration over the last couple of decades has concentrated in the La Plata and Animas

drainage units. Subsequently, these areas have been more intensively surveyed than the rest of the project area. Also, site visibility is greater in the western units than the eastern ones where extensive modern agricultural fields have destroyed or masked surface remains. Informal interviews with local residents, ranchers, and collectors indicate that archaeological sites are no less frequent on unsurveyed private lands, than they are on Tribal and Federal lands where surveys have been concentrated.

Prehistoric and Ethnohistoric Era Resource Sensitivity Zones

Sensitivity of archaeological sites reflecting native occupation of the project area is based on estimates of variation in site densities. However, the available survey information has several limitations that preclude development of rigorous quantitative estimates of site density. The archaeological literature documents several instances of reported, but not recorded, site concentrations, such as along the Pine River Valley. Also, many of the surveys on SUIR have been conducted with an avoidance policy that results in avoided sites being left unrecorded. Therefore, site densities are under reported.

Virtually all researchers working in the region note correlations between site locations and river courses. However, Wilshusen's (1995) recent work just south of SUIR has documented some of the highest site densities in the region (about 45 sites per square mile) in intermittent, secondary drainages well away from the primary river courses.

Available information suggests that other factors also influence archaeological site distributions although again rigorous quantitative data are unavailable. For example, aspect seems to be an important variable because sites tend to cluster on southeast-facing slopes and be less common on northwest-facing slopes. Open habitation sites are usually found in gentle terrain with slopes of less than 10 degrees. Conversely, other types of sites, such as rock shelters, cliff dwellings, rock art, and many Navajo sites are more common in areas of considerable topographic relief. Site densities also appear to vary with natural vegetation, which responds to different elevations, soil types, and topography. Pine and oak brush vegetation zones generally have low site densities, with densities of approximately fewer than 10 sites per square mile being commonly reported (Hovarth 1981; Martorano and others 1985). Riparian and piñon-juniper-sage zones have higher than average densities, sometimes exceeding 40 sites per square mile (for example, Wilshusen 1995).

In sum, only limited areas of SUIR appear to have low densities (approximately 0 to 9 sites per square mile) of archaeological sites. These include some badlands and cliffs with extreme topographic relief (usually 50 degrees or more of slope), plus limited areas of pine and oak brush vegetation and pockets of lands altered by historic and recent development (see Figure 3.7-3). Areas projected to moderate site densities (approximately 10 to 19 sites per square mile) are broadly scattered across much of the project area. Usually these areas feature homogeneous terrain or vegetation or both, and include broad open mesas under cultivation in the eastern portion of the project area, and more scattered undulating uplands with piñon-juniper vegetation. Areas projected

to have high site densities (approximately 20 or more sites per square mile) are expansive, incorporating the major river valleys as well as many more minor tributary drainages.

Future inventories within the defined sensitivity zones are likely to report varied site densities, and the sensitivity model certainly will warrant refinement as future surveys are completed. Although the sensitivity model is not rigorously quantitative, it is "professionally informed," and provides a basis for comparing the relative levels of impacts of the alternatives considered in this EIS.

Historic Era Resource Sensitivity Zones

The most ubiquitous historic resources within the project area are expected to be homestead and allotment sites. For each of the 24 townships within or partially within the project area, the location of each homesteading effort and Indian allotment was identified (3,517 in all). To characterize the potential for finding sites reflecting homesteading activities in a section, each type of activity was assigned a value:

Indian allotments	5 points
patented homesteads entries	5 points
unpatented homestead entries	1 point
patented desert land entries	5 points
unpatented desert land entries	1 point
patented stock raising homestead entries	2 points
unpatented stock raising homestead entries	1 point
cash entries	2 points

For other historic resources, the following values were assigned:

ditches	2 points
unnamed roads	5 points
named roads	10 points
railroads	20 points
ranches	5 points
cemeteries	5 points
sawmills	5 points
oil and gas locations	2 points
coal locations	2 points
communities	20 points
large settlements (Ignacio and Ignacio Agency)	40 points

The assigned values are based on prior experience with trying to identify similar historic properties on the ground. Each of these values assigned to each section (approximately one square mile) were combined to create an overall historic site sensitivity map. Cumulative values for each section in

the study area ranges from 0 to 80, and these index values were used to define four sensitivity zones (see Figure 3.7-4) using the following criteria:

very low sensitivity	0-7 points
low sensitivity	8-20 points
moderate sensitivity	21-38 points
high sensitivity	39-80 points.

In general, homesteading and Indian Allotment sites, as well as water control sites, are ubiquitous along the Piedra, Pine, Florida, Animus and La Plata Rivers. These sites are also common along the smaller tributaries especially on the upper reaches of the La Plata, Florida and Pine Rivers and on Beaver Creek, all in the northern portion of the Reservation. Locations where they are less common include all areas with less surface water and higher elevations. These are the southwest corner of the Reservation; most of the region between Spring Gulch, east of the La Plata, and the Animas River; Mesa Mountain; and the Piedra Peak foothills. Curiously, the centrally-located and well-watered area between the Upper Pine River and Ignacio Creek also appears to have been almost completely ignored by homesteaders.

Oil and gas exploration sites tend to be where homesteading was not pursued, especially in the area between the lower La Plata and Animas rivers. Coal mining was centered around the Cinder Buttes, but small mines might be located in a number of canyons near exposed coal seams in the La Plata drainage. Sawmills are most likely near access roads in large stands of ponderosa pine.

Most other sites such as communities, standing structures, railroad facilities and cemeteries will be located along the narrow north-south transportation corridors of the La Plata, Animas, Pine, and Piedra rivers as well as the northwest to southeast-trending rail corridor between Durango and Arboles. However, the historic town of Arboles and the many historic resources in that area have been inundated by Navajo Reservoir.

IMPACT ASSESSMENT STRATEGY

The main purpose of EISs is to identify and address potential "significant" environmental impacts. This section discusses the criteria used to define what would be considered significant impacts on cultural resources within the context of this project, and describes the impact assessment methods used to evaluate and compare the project alternatives.

Defining Significant Impacts

Regulations implementing NEPA stipulate that defining "significant" impacts requires consideration of "context" (such as national, regional, or local), and "intensity" (40 CFR Part 1508.27). For this project, the issue of context is most easily addressed. Given the programmatic nature of the

proposed oil and gas development across much of SUIR, a region encompassing approximately the western two-thirds of SUIR is deemed to be the most appropriate context for evaluation of impacts.

NEPA regulations identify one factor to be considered in evaluating intensity of impacts as “the degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources” (40 CFR Part 1508.27[8]). As indicated at the beginning of this appendix, numerous laws protect cultural resources. The principal laws that provide guidance for identifying significant impacts on National Register eligible properties and other types of cultural resources include the:

- National Historic Preservation Act
- Archaeological Resources Protection Act
- American Indian Religious Freedom Act
- Native American Graves Protection and Repatriation Act

The following sections discuss the intensity of potential impacts with respect to guidance provided by each of these laws.

National Historic Preservation Act

Regulations for *Protection of Historic Properties* (36 CFR Part 800), which primarily implement Section 106 of the National Historic Preservation Act, stipulate that Federal agencies consult with State Historic Preservation Officers, the Federal Advisory Council on Historic Preservation, and other interested parties to make one of four possible determinations of effect:

- no historic properties within the area of potential effect
- no effect
- no adverse effect
- adverse effect

These regulations further indicate that an undertaking will affect a historic property when it "may alter characteristics of the property that may qualify the property for inclusion in the National Register," which could involve "alteration to features of the property's location, setting, or use" (36 CFR Part 800[a]). An effect is defined as adverse when it may "diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include, but are not limited to:

(1) Physical destruction, damage, or alteration of all or part of the property;

(2) Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualification for the National Register;

(3) Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting;

(4) Neglect of a property resulting in its deterioration or destruction; and

(5) Transfer, lease, or sale of the property" (36 CFR Part 800.9[b]).

It is recognized that the proposed oil and gas development potentially could result in the types of adverse impacts identified as 1 and 3.

The available inventory data indicate that no cultural resources within the project area have actually been listed on the National Register, but many are undoubtedly National Register eligible. The vast majority of cultural resources previously recorded within the project area are archaeological sites. Although few of these sites have been formally evaluated, many probably have potential to yield important information and therefore are National Register eligible under criterion D (refer to the discussion of regulatory requirements at the beginning of this appendix). The regulations for *Protection of Historic Properties* specifically state that when such informational values can be substantially preserved through the conduct of appropriate research, and such research is conducted in accordance with applicable professional standards and guidelines, impacts on such sites can be considered to be not adverse (36 CFR Part 800.9[c][1]).

Although the compiled inventory data indicate that potentially National Register eligible properties are relatively dense within the project area, many specific oil and gas development projects would have small impact zones that could be adjusted and modified. Therefore, potential to avoid direct impacts to historic properties is high, and determinations of no properties or no effect are likely to be appropriate for many projects. While it may be impossible to completely avoid all cultural or historic properties regardless of which alternative is selected, per CFR 800.6(b)(iv), the execution of an MOU between the Agency Official and SHPO to implement mitigative data recovery studies could resolve any potential adverse effects.

Archaeological sites also are sometimes valued for characteristics other than their information potential, especially by traditional American Indian groups affiliated with those sites. A few sites in the project area have been identified as related to historic or protohistoric Ute origins, and Navajo, Apache, and Puebloan groups residing in the Four Corners region will consider many other archaeological sites as affiliated with their ancestors. Typically American Indians prefer to have archaeological sites preserved in place, but special concerns often focus on protection of sites that contain human remains. Physical destruction, damage, or excavation of human remains is usually considered to be an adverse effect under 36 CFR Part 800. Treatment of human remains, funerary objects, sacred objects, and objects of cultural patrimony also are specifically addressed by the Native American Graves Protection and Repatriation Act as discussed below.

Human remains are more commonly associated with habitation than non-habitation sites. Approximately 40 percent of the recorded archaeological sites appear to have architectural remnants indicative of habitation activities. Human burials may be present in many of these sites but could

be present in other types of sites as well. Although these sites are relatively common, the potential to avoid impacts to such sites is high because of the relative flexibility of oil and gas facilities.

Some cultural resources may be significant for qualities other than their information potential (that is, National Register eligible under criteria A, B or C), and disturbance or destruction of the historic values of such sites would be considered adverse. However, these types of properties are likely to be much less common than those important for their information. Also, prior development is likely to have already altered the setting of many of these resources.

Because detailed inventory data will be compiled only for specific projects pursued after completion of this EIS, the impact assessment conducted at this programmatic phase of analysis is only a projection of the probable outcomes of subsequent formal Section 106 consultations. These consultations can be completed only after inventory and evaluation of cultural resources within the impact zones of specific projects are completed. Previous Section 106 consultations for oil and gas developments on SUIT typically have resulted in determinations of no historic properties or no effect. It is quite likely that consultations for the majority of specific oil and gas projects that may be approved for future development would result in such determinations as well. Determinations of adverse effect are expected to be warranted only rarely, if at all.

Archaeological Resources Protection Act

The Archaeological Resources Protection Act prohibits unauthorized excavation, collection, or damage of archaeological resources on Federal and Tribal lands, as well as trafficking in such resources. Implementing regulations define archaeological resources as "any material remains of human life or activities which are at least 100 years of age, and which are of archaeological interest" [*Protection of Archaeological Resources: Uniform Regulations*, 43CFR Part 7.3(a)]. The law specifically requires notification of affected Indian Tribes if archaeological investigations proposed in a permit application would result in harm to or destruction of any location considered by Tribes to have religious or cultural importance. Resources protected by this act would be routinely considered as part of Section 106 consultations.

American Indian Religious Freedom Act

The American Indian Religious Freedom Act reiterates First Amendment guarantees of religious freedom with specific reference to the inherent right of indigenous peoples to believe, express, and exercise their traditional religions, including but not limited to access to religious sites, use and possession of sacred objects, and freedom to worship through ceremonial and traditional rites. Federal agencies are directed to evaluate their policies and procedures to determine if changes are needed to ensure that such rights and freedoms are not disrupted by agency practices. Amendments of the National Historic Preservation Act enacted in 1992 specifically stipulate that properties of traditional religious and cultural importance to an Indian Tribe may be determined to be eligible for inclusion on the National Register, so the types of resources protected by the American Indian Religious Freedom Act usually are considered in conjunction with Section 106 consultations.

Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act gives Native Americas ownership or control of human remains, funerary objects, sacred objects, and objects of cultural patrimony found on Federal and Tribal lands. The law provides for such remains in Federal museum collections to be inventoried and repatriated to related Native Americans or affiliated Native American groups. Implementing regulations stipulate that such remains and objects can be intentionally excavated on Federal and Tribal lands only after consultation and approval of a plan that provides control or right of possession of those remains and objects to related descendants or affiliated groups (*Native American Graves Protection and Repatriation Act Regulations*, 43 CFR Part 10.3). The regulations also define consultation procedures for inadvertent discoveries of such remains and objects on Federal and Tribal lands (Section 10.4).

Human remains and objects protected by this Act are likely to be present at some archaeological sites within the project area. Therefore these remains and objects would be considered under Section 106 consultations, and impacts to such remains and objects would be characterized as adverse effects. Prior development on SUIT has resulted in disturbance of only two or three human burials (personal communication, Bruce Harrell, Archaeologist, Albuquerque Area Office, BIA, 20 November 1996).

Criteria for Significant Impacts

Damaged or destroyed cultural resources sometimes may be partially restorable or reconstructible, but they are essentially non-renewable. Guidance provided by laws and regulations protecting cultural resources indicate that the permanent loss of significant cultural resources is considered "adverse," but this does not necessarily correlate to a "significant" impact within the context of NEPA. The laws protecting cultural resources create opportunities to consult with interested parties and usually ways to avoid or mitigate impacts are identified through these consultations. Therefore a determination of "adverse effect" for impacts to a single cultural resource, in most cases, would not warrant preparation of an EIS for a specific project if it has no potential for significant impacts

on other types of resources. But how many significant cultural resources would have to be adversely effected to be considered "significant" within the context of NEPA? To address this issue the NEPA mandated analysis of the "intensity" of impacts to cultural resources considered the (1) susceptibility of resources to impacts, (2) quality of the affected resources, (3) numbers of resources affected, and (4) duration of the impacts.

In response to project scoping and compilation of an inventory of previously recorded cultural resources, the specific types of resources considered include (1) archaeological and historical sites, (2) and traditionally used cultural plants. The intensity of potential direct and indirect impacts to each type of resource are summarized on Table 6, and discussed in the following sections.

TABLE 6
SUMMARY EVALUATION OF THE INTENSITY OF POTENTIAL DIRECT AND INDIRECT IMPACTS

Type of Impact	Susceptibility to Impacts	Resource Quality	Resource Quantity	Impact Duration
Direct Impacts to Archaeological and Historical Sites				
ground disturbing construction activities	very	moderate to high	limited	permanent
Indirect Impacts to Archaeological and Historical Sites				
increased erosion	very	moderate to high	limited	permanent
land subsidence	very	moderate to high	limited	permanent
increased human presence	moderate	moderate to high	limited	permanent
degradation of air quality	moderate	moderate to high	very limited	long term
Direct Impacts to Traditionally Used Plants				
ground disturbing construction activities	moderate	unknown	limited	short to long term
Indirect Impacts to Traditionally Used Plants				
increased erosion	low	unknown	limited	short to long term
loss of native species	moderate	unknown	limited	short to long term

Archaeological and Historical Sites

The most severe potential direct impacts to archaeological and historical sites stem from ground disturbance associated with construction of new drill pads, flow lines, produced water lines, gas injection lines, central delivery point facilities, and access roads. Potential indirect impacts include (1) increases in erosion or ground subsidence that could disturb archaeological deposits; (2) increases in human presence that could result in inadvertent damage by activities such as off-road vehicular traffic, or vandalism by work crews; (3) and changes in air quality that could decrease visibility or increase the acidity of precipitation, which could degrade public interpretation potential and perhaps increase the rate of disintegration of some types of archaeological and historical properties.

Archaeological and historical sites, by their nature, tend to be very susceptible to ground disturbing activities, whether due to direct construction or indirect increases in erosion or vandalism. These sites are somewhat less susceptible to increased human presence simply because many are buried and often difficult to recognize. Susceptibility to degraded air quality is rated no more than moderate.

As discussed above, the quality of the archaeological and historical sites is gauged within the regulatory framework by determining whether or not they are eligible for listing on the National Register of Historic Places. The quality of these resources certainly can be considered on an expanded, graded scale as well. Some resources such as those developed for public interpretation in Mesa Verde National Park or at the Chimney Rock Archaeological Area managed by the San Juan National Forest would be perceived by most as of significantly higher quality than a scatter of lithic debitage. Similarly, the informational value of sites could be graded by archaeologists, and Native Americans may very well perceive the values of various types of sites differently. In general, the quality of the archaeological and historical resources of the project area can be rated as moderate to high.

Some parts of the study area are documented to have densities in excess of 40 archaeological and historical sites per square mile, which is characterized as relatively high. However, the impact models indicate that the areas of potential direct effect are relatively small, and therefore the quantity of archaeological and historical resources subject to direct impact are rated as limited.

Potential impacts of indirect impacts, related to erosion, increased human presence, and activities beyond the right-of-way could add a substantial increment to the level of direct impacts for all alternatives. However, Tribal procedures would address these issues during review of all proposed specific projects and therefore the quantity of resources that could be indirectly affected also is characterized as limited.

In addition, Alternative 3 has potential to alter air emissions because of gases vented by the compressors needed to develop injection pressures. The resources susceptible to indirect impacts of degraded air quality are much more limited than other types of archaeological and historical sites, and concerns are likely to focus primarily on the Mesa Verde National Park and Chimney Rock Archaeological Area. These impacts are addressed in the consideration of air quality issues.

The duration of impacts on archaeological and historical sites is expected to be permanent in most cases, because once destroyed, the values of those sites are lost forever. The one exception would be indirect impacts due to any degradation of air quality, which are expected to be long term. However, any impacts due to degraded visibility should end if air quality were to be restored after the life of the project.

In sum, archaeological and historical sites within the project area are very susceptible to most direct and indirect types of impacts, the resources are of relatively moderate to high quality, and most impacts would be of permanent duration. Archaeological and historical sites are relatively abundant within the project area, but because the areas of potential effects are relatively small the number of resources that could be disturbed or destroyed by oil and gas developments are expected to be a small percentage of the extant resources in the study area. Given the potential for avoiding or satisfactorily mitigating adverse impacts that might be identified during review of subsequent specific projects, the intensity of impacts on archaeological and historical sites, considered within the regional context of the project area, is not expected to be significant.

Traditionally Used Plants

Ground disturbing construction activities were identified as a source of potential direct impacts to traditionally used plants. Vegetation within construction zones is likely to be temporally eradicated, but is expected to regenerate within temporary construction zones not occupied by project facilities. Traditionally used plants would constitute only a portion of the natural vegetation disturbed by direct impacts. More indirect impacts could result from increased erosion that could alter natural vegetation, introduce non-native species, and lead to loss of native species. Again, traditionally used plant would be only a subset of this disturbed vegetation, and these impacts are expected to be relatively low to moderate.

Characterization of the current distribution and condition of traditionally used plants is hampered by lack of documentation about the extent of continuing traditional uses of plants and the species of plants exploited. However, the susceptibility of traditionally used plants to direct and indirect impacts is rated as limited, because the extent of disturbance is expected to be relatively minor.

The loss of plants within project facilities would be long term, but potentially could be recovered after the life of the project. Loss of plants in temporary construction areas would be short term. There is substantial potential to mitigate impacts that might be identified during evaluation of subsequent specific projects by modifying projects to avoid any particular sensitive species or propagating those species in other settings, although such artificial manipulation may be deemed culturally unacceptable (Northern Arizona University and SWCA 1996:182). In sum, the intensity of impacts on traditionally used plants is not expected to be significant.

Less than Significant Levels of Impact

Although the impacts to cultural resources from the proposed oil and gas development are not characterized as significant within the context of the NEPA analysis, the impacts characterized by the assessment methodology as low to moderate will need to be addressed in compliance with other cultural resource regulations. A cultural resource sensitivity model, based on results of prior inventory surveys and review of historic land use maps, defines low, moderate, and high sensitivity zones based on projections of the density and complexity of cultural resources, especially archaeological sites. Different levels of projected impacts within these sensitivity zones are indicative of the relative efforts that could be required to develop and implement impact avoidance or mitigation measures, and provide a basis for comparing the project alternatives.

Estimating Potential Impacts

The projection of the potential extent of direct impacts on prehistoric and ethnohistoric archaeological sites and historic resources is based on estimates of the number of acres to be disturbed in modeled zones of low, moderate, and high sensitivity. The geographical information system database developed for the project was used to make these calculations. The number of acres was then multiplied by estimates of site density within each zone to derive an approximation of the number of resources that might be present within those zones. Similarly, acres of disturbance were estimated for very low, low, moderate, and high historic resource sensitivity zones. The results provide another parameter for comparing the alternatives.

Analyses of erosion potential, subsidence potential, and air quality degradation undertaken by other project team specialists provide the basis for a more qualitative consideration of identified potential indirect impacts on archaeological and historical sites.

Because the extent of traditional use of plants and the exploited species have not been identified, no quantitative impact analysis was possible. However, the analysis of "context" and "intensity" as discussed above concluded that none of the project alternatives are expected to have significant impacts to these resources.

The impact models in combination with the sensitivity models indicate that the numbers of sites that could be affected is relatively limited compared to the regional resource base.

Alternative 1 is the status quo option that involves continuing conventional oil and gas development under current authorizations. If the maximum level of development is pursued under existing approvals, approximately 691 acres of additional ground disturbance is projected. If the Southern Ute Tribe's claim to methane in disputed coal lands is upheld, the impact model projects that an additional 101 acres might be disturbed by the currently authorized conventional development.

The impact model suggests that as much as about 60 percent of the ground disturbance could occur in high sensitivity zones for prehistoric and ethnohistoric sites, with the remainder in moderate and

low sensitivity zones. If an average of 40 sites per square mile in high sensitivity zones is assumed, with an average of 20 sites per square mile in moderate and low sensitivity zones, it can be estimated that approximately 40 sites might be present within the impact zones of Alternative 1, which aggregate to approximately 1.2 square miles. The assumed site densities are at the upper end of the documented range of densities, and should compensate for the "edge effect" that increases the numbers of sites encountered by linear projects in contrast to block areas. The impact model indicates that only about 8 percent of ground disturbance would occur in areas rated as having high sensitivity for historical resources. There is a considerable margin of potential error for these estimates, but even if doubled or tripled, only a fraction of a percent of the high sensitivity areas and baseline cultural resources within the study region are likely to be affected. Also, because specific projects would be relatively flexible, modifications can probably be made to avoid direct impacts to most archaeological and historical sites that might be identified by pre-construction surveys.

Alternative 2, the decreased well spacing option, is projected to result in a maximum of approximately 1,300 acres of new ground disturbance on Tribal lands, plus up to an additional 726 acres if development were to proceed in the disputed coal lands. That is about two and one-half times more disturbed acreage than projected for Alternative 1. The impact model indicates that a maximum of about 80 percent of this disturbance could occur in zones rated as having high sensitivity for prehistoric and ethnohistoric sites. In contrast, a maximum of about 20 percent of the disturbance is likely within zones rated as having high sensitivity for historic resources.

If an average of 40 sites per square mile in high sensitivity zones is assumed, with an average of 20 sites per square mile in moderate and low sensitivity zones, it can be estimated that approximately 113 sites might be present within the impact zones of Alternative 2, which aggregate to approximately 3.2 square miles. Again this estimate could be subject to considerable error, but even if doubled or tripled, less than one-half percent or less of the high sensitivity zones for archaeological and historical sites within the study area would be affected. This level of development could affect two to three percent of the high sensitivity zones on the more limited Tribal lands. As with Alternative 1, there is good potential for modifying specific projects to avoid direct impacts to any archaeological and historical sites that may be identified by pre-construction surveys.

Alternative 3 combines the option of decreased spacing plus pressurization to enhance oil and gas recovery. Pressurization is projected to require 90 injections wells, half on Tribal lands and half on the disputed coal lands. These are expected to result in disturbance of approximately 3 to 4 percent more acreage than Alternative 2 (about 73 acres), or an aggregate of about 3.3 square miles. Therefore the impact model projects that Alternative 3 is likely to affect only about four more archaeological and historical sites than Alternative 2.

Although the level of potential impacts on cultural resources for all alternatives is not characterized as significant, one hundred or more archaeological and historical resources could be present within specific development project areas. Substantial efforts will be required to inventory, evaluate, and develop measures to avoid or mitigate impacts to these sites. In addition, efforts will be required to consider and address sometimes overlooked potential indirect impacts from erosion, increased human presence, and potential activities beyond project rights-of-way.

If additional oil and gas development is approved, the level of required cultural resource investigations could increase substantially, and a program to plan and coordinate these efforts may be warranted. Current inventory procedures, which result in no information being collected about narrowly avoided archaeological and historical sites, should be rethought because it creates gaps in the database of cultural resources on Tribal lands. More complete information, centralized at the Tribal headquarters, may very well enhance the effectiveness of cultural resource considerations as future oil and gas developments, and other Tribal initiatives, are planned.

Cumulative Impacts

Oil and gas developments have been pursued on SUIR for some 60 to 70 years, but other types of development have been pursued for more than a century within the project area. These developments have affected many cultural resources but the extent of loss has not been documented. Prior oil and gas development affected some archaeological and historical sites prior to the advent of current regulatory protection in the 1970s. Since the adoption of cultural resource review procedures, subsequent oil and gas developments have been routinely modified to avoid significant archaeological and historical sites, and therefore have not contributed to cumulative impacts.

To gauge how the alternatives for future oil and gas development could contribute to cumulative impacts of recent and future projects, three projects were reviewed: (1) Tiffany Enhanced Coalbed Methane Recovery Project, (2) Transcolorado Gas Pipeline Project, and (3) Animas-La Plata Project.

Survey for the Tiffany Project identified 25 archaeological and historical sites; 19 of these were considered to be significant or potentially significant (BLM 1996). The project was modified to avoid four of these sites, and to confine construction activities to previously disturbed corridors through the other 15 sites. Therefore, the project did not result in any impacts to significant archaeological and historical sites.

Survey for the Transcolorado Pipeline identified 23 archaeological and historical sites within the project corridor through SUIR; 16 were determined to be significant (Reed and others 1992). Given the difficulty of modifying the route of this large pipeline, site avoidance is not a practical option. Five sites are slated for extensive mitigative data recovery studies, and more limited investigations would be conducted at the other 11 sites, if the project were to be developed.

The Animas-La Plata Project is a water resource development proposed by the Bureau of Reclamation. The extent of impacts of the Animas-La Plata Project on cultural resources within SUIR cannot be projected with any confidence at this time, because the Southern Ute Tribe has not developed plans for use of the water that would be delivered to the Reservation. However, the potential extent of impacts is substantially greater than for the Tiffany or Transcolorado projects.

The Cultural Resources Affected Environment Section of the July, 2000, Final Supplemental EIS for the Animas-La Plata Project (A-LP FSEIS) states: "In his 1996 report on what is now referred to as Alternative 7, Chenault (1996) estimated that development activities (not including those at

Ridges Basin reservoir) would result in a 43.5 percent impact rate to cultural resources. While that study was oriented towards irrigation development, which is not an element of either Refined Alternative 4 or 6, the types of activities are similar enough that the 43.5 percent figure is still considered valid. Therefore it is estimated that Refined Alternative 4 will impact up to a total of 639 sites; Refined Alternative 6 will impact up to 864 cultural resource sites. Either Alternative will result in impacts significantly less than those estimated for Alternative 7, which was estimated to impact up to 1,600 cultural resource sites. Since many of the prehistoric sites for either Refined Alternative are habitation sites which date between the Basketmaker II to Pueblo III time periods, and others represent protohistoric Navajo and Ute sites,they also may be considered TCPs (and likely to contain burials); their identification and treatment are of considerable concern to many of the consulting Tribes."

The Cultural Resources Environmental Consequences Section of the A-LP FSEIS states that for Refined Alternative 4: "Ground disturbance and other activities associated with construction of structural components would disturb and/or destroy cultural resources. Due to the known significance of the area (Ridges Basin is a National Register-eligible District), the impacts to an estimated 80-90 sites is considered significant. Sites would be directly affected by construction of Ridges Basin Reservoir and its associated features. The potentially affected sites include Archaic period sites, Anasazi (Ancestral Pueblo) habitation and limited-use sites, historic Native American sites, a portion of the Old Ute Trail (also the route of the Dominguez-Escalante Expedition), and historic Euroamerican sites."

The September 25, 2000, Record of Decision for the A-LP FSEIS selected Refined Alternative 4 to implement the Colorado Ute Indian Water Rights Settlement Act of 1988.

Other developments in the region, including oil and gas development on adjacent fee lands, oil and gas development within the San Juan Basin in general, and other contemplated projects such as upgrading State Road 550, also have or will lead to the loss of archaeological and historical sites in the region. Although quantitative data to gauge the impacts of these activities have never been compiled, the BLM has organized large survey and data recovery efforts within the New Mexico portion of the San Juan Basin.

Alternative 1, which represents continued oil and gas development under currently approved leases, is likely to contribute to cumulative impacts equivalent to at least two or three Tiffany Projects. Alternatives 2 and 3 are likely to represent at least a tripling of the Alternative 1 increment. This level of impact will certainly add to cumulative impacts within the region. However, because of the potential to modify oil and gas development projects to avoid adverse impacts to archaeological and historical sites, the increment to cumulative impacts are likely to relatively moderate, especially compared to less flexible projects such as the Transcolorado Pipeline and the Animas-La Plata Water Project.

Mitigation

The standard Tribal procedures for oil and gas development includes compliance with Section 106 of the National Historic Preservation Act. This includes arranging for cultural resource surveys, evaluating discovered sites, and assessing the effects in consultation with the BIA, SHPO, and other interested parties. Most individual projects are likely to require development and implementation of measures to avoid or mitigate impacts identified along an approved route. These measures could entail archaeological monitoring of construction activities to prevent inadvertent damage to nearby archaeological and historical sites, and preconstruction archaeological data recovery studies are likely to become more necessary as the density of developments increases.

If the Southern Ute Tribal government should decide that traditional cultural concerns warrant further attention during subsequent development of specific oil and gas projects, they have the opportunity to do so because the Tribe has key rights and responsibilities in the environmental review process. The Tribe also could initiate broader studies in conjunction with the Tribal planning program, such as inventorying and mapping the distribution of traditionally used plant species.

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APPENDIX L
AIR QUALITY IMPACT TECHNICAL SUPPORT DOCUMENTS

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AIR QUALITY IMPACT TECHNICAL SUPPORT DOCUMENTS

The following technical support documents describe the processes used in the air quality impact assessment and provide summaries of relevant data:

Dames and Moore. 2000.* Air Quality Impact Assessment Technical Support Document (Volume I - Executive Summary, Emissions Inventory and Near-field Analysis), Oil and Gas Leasing and Development on the Southern Ute Indian Reservation, Environmental Impact Statement. Prepared for the U.S. Department of the Interior, Bureau of Land Management, Colorado State Office, by Dames & Moore. San Diego, CA.

Earth Tech, Incorporated. 2000. Air Quality Impact Assessment Technical Support Document (Volume II - Far-field Analysis), Oil and Gas Leasing and Development on the Southern Ute Indian Reservation, Environmental Impact Statement. Prepared for the U.S. Department of the Interior, Bureau of Land Management, Colorado State Office, by Earth Tech, Incorporated. Concord, MA.

Copies of these technical support documents are available upon request from:

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Denver Federal Center, Building 50
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(303) 236-6400
FAX 236-3508

scott_archer@blm.gov

* During the Public review and comment period, it was determined that the near-field cumulative carbon monoxide and nitrogen dioxide production phase impact analyses were erroneous because the Emission Parameters for Sources on Tribal Lands Included in the Cumulative Impact Analysis (Table 6-4 on Page 38 of Volume I - Emissions Inventory and Near-field Analysis of the Air Quality Impact Assessment Technical Support Document) used an incorrect unit of measure conversion factor for the emission source stack diameters. The erroneous values were not used in the near-field construction, near-field formaldehyde, nor any of the far-field modeling analyses.

Replacement Pages 38 through 40, and 49 through 55 are provided to correct those erroneous pages previously included in Dames and Moore (2000).

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APPENDIX M
TIFFANY CONTINGENCY PLAN

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Nitrogen Injection Project
La Plata County, Colorado
Groundwater Monitoring Program
and Contingency Plan
February 19, 1992

Objectives:

The objective of this program is twofold.

First, determine the affect that the subject project will have on methane and nitrogen content in shallow groundwater.

Second, develop a contingency plan that will address adverse impacts to groundwater that are attributed to nitrogen injection.

I. Method:

Groundwater in the area of review will be sampled on a monthly basis for methane content. If methane content' increases, then nitrogen content and methane Carbon 13 isotope analysis will also be conducted. Groundwater samples will be taken from monitoring wells which will include the two domestic water wells in the area of review, eight new groundwater monitoring wells in the study area and three out-of-area monitoring wells for control data.

The three out-of-area wells will be located at least one half mile away from the nearest nitrogen injection well and will function as control wells. These wells are included in the program so that natural variations in methane and nitrogen concentrations can be assessed. Seasonal variations in water quality are common, and these wells will provide control data for. such variations. For example, if methane concentrations increase by similar proportions in both the area-of-review wells and the out-of-area wells, then that would indicate that variations were natural rather than induced by the Nitrogen Injection Pilot Project.

Gas samples will be taken from the Fruitland Coal producing well within the Nitrogen injection pattern and from each of the four Fruitland Coal producing wells immediately surrounding the injection pattern. These gas samples will be analyzed for composition and Carbon 13 levels in the methane.

Note: **Water well owner permission** for sampling and monitoring well drilling will not be pursued until EPA has approved this program. Samples will not be taken from domestic water wells without the well owner's permission.

Monitoring Wells:

Eight monitoring wells will be drilled and completed within the area-of-review as shown in the attached map. These newly drilled monitoring wells-are denoted MI through M8 on the attached map. These wells will provide groundwater information within the injection well pattern and at the edges of the area-of-review. Well pattern is controlled by access. As shown on the map, all but three of the wells will be drilled on the section line. one well will be drilled adjacent to a new injection well and the other will be drilled adjacent to a converted injection well.

As required by the permit, the two domestic water wells within the Area-of-Review will also be monitored (see locations on the attached map).

Three groundwater monitoring wells are located at least one half mile away from nitrogen injection wells and will function as control wells (see locations on attached map). These wells are existing domestic water wells and are denoted Cl, C2 and C3.

Sampling:

A background sample will be taken from each groundwater monitoring well in the week before nitrogen injection begins.

All subsequent groundwater monitoring wells will be sampled in the first week of each month after *injection begins* and analyzed for methane and *nitrogen concentration*. Samples will be taken from each wells after two wellbore volumes have been pumped from the wells.

Sample bottles will be marked with the following information:
Monitoring Well Identifier (ie. Cl).
Sample Date and Time (ie. Mar. 31, 1992, 15:00 hours)
Samplers Name (ie. John Doe)

Samples will be taken in 40ml glass bottles. Each bottle will be completely filled, leaving no headspace. All samples will be delivered to the lab for analysis within 24 hours of sampling.

Analysis:

Methane concentration will be determined by the headspace method and will be reported as the concentration of methane in the headspace.

The headspace analysis is a two step process:

Step 1) Simultaneously inject 5ml of helium and extract 5ml water.

Step 2) Extract 0.1 to 1 ml of headspace vapor and analyze in gas chromatograph with detection limits less than or equal to 7 parts per million for methane and 25 parts per million of Nitrogen.

Analysis will be performed within 72 hours after the samples are taken.

Reporting:

Analysis results will be reported to the EPA by the 20th day of each month after nitrogen injection begins.

Contingency Plan:

This contingency plan will have several response actions that will vary according to the data. Following is a description of the "triggering events" and the associated response actions.

In all Response Levels, if domestic water wells are adversely affected by the nitrogen injection process, safety impacts to those domestic water well users will be assessed immediately. If safety is threatened, provide water to domestic water well users until methane concentrations are reduced to safe **levels or provide a water** treatment system to ensure safe domestic water supply to affected users.

Level 1

Condition for Response - Methane concentration in one or two area-of-review monitoring wells increases by at least 1000 ppm or 10% of the methane concentration detected before injection began, whichever is greater. Methane concentrations in control wells have not changed since injection began.

Response Action - Within 24 hours of receiving the analysis data, Amoco will take four samples from the well exhibiting the increased methane concentration. Have two of the samples analyzed for headspace methane and nitrogen concentration. The other two samples will be taken in evacuated cylinders leaving a headspace and will have the methane in the headspace analyzed for the Carbon 13 isotope levels. Begin weekly sampling of monitoring wells exhibiting 10% or 1000 ppm methane concentration increase.

Level 2

Condition for Response - Methane and/or nitrogen concentrations continue to increase in two consecutive samples on two or more monitoring wells by 1000 parts per million or 10%, whichever is greater and Carbon 13 levels are identical to Fruitland Coal gas samples taken prior to the nitrogen injection. Methane concentrations in control wells unchanged since injection began.

Response Action - Stop injection into nearest nitrogen injection wells) and continue weekly sampling of monitoring wells exhibiting increasing methane and nitrogen concentrations.

Level 3

Condition for Response - All monitoring wells in study are exhibiting 1000 ppm or 10% increase, whichever is greater, in methane concentration since before injection began and immediate follow up sampling confirms increased methane and nitrogen concentration measurements. Methane concentrations in control wells are unchanged since injection began.

Response Action - Stop injection into all nitrogen injection wells and begin weekly sampling and analysis of monitoring wells. Resume monthly sampling after four weekly samples are taken.

Level 4

Condition for Response - All conditions of Level 3 are met and methane concentrations in all monitoring wells continue to increase through the first month of weekly sampling.

Response Action - PRIMARY OBJECTIVE IS TO REDUCE FRUITLAND COALBED RESERVOIR PRESSURE IMMEDIATELY. Vent all Nitrogen Injection Wells to Atmosphere. Continue to produce all Fruitland Coal wells within at least one mile of study area. Continue sampling all monitoring wells weekly until methane concentrations stop increasing, then start monthly sampling of monitoring wells until methane concentrations equal or are less then the concentrations detected before injection began.

APPENDIX N
TRAFFIC AND TRANSPORTATION

APPENDIX N
TRAFFIC AND TRANSPORTATION

TABLE N-1
TOTAL WELL DEVELOPMENT AND SERVICE TRIPS–ALTERNATIVE 1

	No. of Wells		*Annual Round Trips per Well by Trip Purpose*						Total Trips	
			Drilling	**Comp. and Test**	**Facilities Installation**	**Pipeline Inst.**	**Workover**	**Operations**		
Well Type	*Tribal Minerals*	*Disputed Coal Lands*	*336*	*45*	*31*	*75*	*6*	*365*	**Well Develop-ment**	**Well Service**
Conventional	269	0	90,384	12,105	8,339	20,041	1,614	98,185	230,668	99,799
Coal Bed	81	62	48,048	6,435	4,433	10,654	858	52,195		53,053
Injection	0	0	-	-	-	-	-	-	-	-
Total	*350*	*62*	*138,432*	*18,540*	*12,772*	*30,694*	*2,472*	*150,380*	*200,438*	*152,852*
									TOTAL DAILY VEHICLE TRIPS	42

Source: Draft Alternatives Description, Leslie Ellwood, Dames & Moore, Facsimile dated 10/24/97; Tiffany EA

TABLE N-2
COMPRESSOR INSTALLATION AND SERVICE TRIP GENERATION–ALTERNATIVE 1

Compressor Size (measured in tons NO produced per year)	Trips Generated	Compressor Installation Trips	New Sites	Service Trips per Site per Year	Average Annual Trips	Daily Vehicle Trips
< 50 tons NO per year	0 pick-up visits per week	181	28	-	-	-
	5-7 crew cab visit per week			312	8,736	5
	0.5 multi-axle visits per year			0.5	14	0.01
50 - 100 tons NO per year	0 pick-up visits per week	181	5	-	-	-
	5-7 crew cab visit per week			312	1,560	1
	1 multi-axle visits per year			1	5	0.00
> 100 tons NO per year	2-5 pick-up visits per day	181	-	1,278	-	-
	3-8 crew cab visit per month			66	-	-
	2 multi-axle visits per year			2	-	-
Total Annual Compressor Maintenance Trips Generated on the Southern Ute Reservation					10,315	6
Total New Compressor Installation Trips					5,973	16
Total First year Trips					16,288	22

Source: Dames & Moore, Inc. and BRW, Inc.

TABLE N-3
COMPRESSOR AND WELL ANNUAL TRIP PRODUCTION–ALTERNATIVE 1

Year	Compressors		Wells		Annual	Ann. Avg.	Avg. Daily
	Service/ Maintenance	Installation	Service/ Maintenance	Installation			
1997	94,082	-	696,977	-	791,059	2,167	243
1998	94,082	597	696,977	10,022	801,678	2,196	272
1999	95,113	597	712,262	10,022	810,352	2,220	274
2000	96,145	597	727,547	10,022	819,026	2,244	277
2001	97,176	597	742,833	10,022	827,700	2,268	280
2002	98,208	597	758,118	10,022	836,374	2,291	282
2003	99,239	597	773,403	10,022	845,048	2,315	285
2004	100,271	597	788,688	10,022	853,722	2,339	288
2005	101,302	597	803,973	10,022	862,396	2,363	290
2006	102,334	597	819,259	10,022	871,071	2,386	293
2007	103,365	597	834,544	10,022	879,745	2,410	296
2008	104,397	-	849,829	10,022	887,821	2,432	297
2009	104,397	-	849,829	10,022	895,464	2,453	299
2010	104,397	-	849,829	10,022	903,107	2,474	301
2011	104,397	-	849,829	10,022	910,749	2,495	303
2012	104,397	-	849,829	10,022	918,392	2,516	305
2013	104,397	-	849,829	10,022	926,034	2,537	307
2014	104,397	-	849,829	10,022	933,677	2,558	309
2015	104,397	-	849,829	10,022	941,320	2,579	311
2016	104,397	-	849,829	10,022	948,962	2,600	313
2017	104,397	-	849,829	10,022	956,605	2,621	315
2018	104,397	-	849,829	-	954,226	2,614	290
2019	104,397	-	849,829	-	954,226	2,614	290
2020	104,397	-	849,829	-	954,226	2,614	290

Source: BRW, Inc.

TABLE N-4
TOTAL WELL DEVELOPMENT AND SERVICE TRIPS–ALTERNATIVE 2

	No. of Wells		*Annual Round Trips per Well by Trip Purpose*						Total Trips	
			Drilling	**Comp. and Test**	**Facilities Installation**	**Pipeline Inst.**	**Workover**	**Drilling**	**Comp. and Test**	
Well Type	*Tribal Minerals*	*Disputed Coal Lands*	*336*	*45*	*31*	*75*	*6*	*365*	**Well Develop-ment**	**Well Service**
Conventional	269	0	90,384	12,105	8,339	20,041	1,614	98,185	230,668	99,799
Coal Bed	367	326	232,848	31,185	21,483	51,629	4,158	252,945	594,248	257,103
Injection	0	0	-	-	-	-	-	-	-	-
Total	*636*	*326*		*43,290*	*29,822*	*71,669*	*5,772*	*351,130*	*468,013*	*356,902*
									TOTAL DAILY VEHICLE TRIPS	98

Source: Draft Alternatives Description, Leslie Ellwood, D&M, Facsimile dated 10/24/97; Tiffany EA

TABLE N-5
COMPRESSOR INSTALLATION AND SERVICE TRIP GENERATION–ALTERNATIVE 2

Compressor Size (measured in tons NO produced per year)	Trips Generated	Compressor Installation Trips	New Sites	Service Trips per Site per Year	Average Annual Trips	Daily Vehicle Trips
< 50 tons NO per year	0 pick-up visits per week	181	11	-	-	-
	5-7 crew cab visit per week			312	3,432	2
	0.5 multi-axle visits per year			0.5	6	0.00
50 - 100 tons NO per year	0 pick-up visits per week	181	13	-	-	-
	5-7 crew cab visit per week			312	4,056	2
	1 multi-axle visits per year			1	13	0.01
> 100 tons NO per year	2-5 pick-up visits per day	181	9	1,278	11,498	6
	3-8 crew cab visit per month			66	594	0
	2 multi-axle visits per year			2	18	0.01
Total Annual Compressor Maintenance Trips Generated on the Southern Ute Reservation					19,616	11
Total New Compressor Installation Trips					5,973	16
Total First year Trips					25,589	27

Source: Dames & Moore, Inc. and BRW, Inc.

TABLE N-6
COMPRESSOR AND WELL ANNUAL TRIP PRODUCTION–ALTERNATIVE 2

Year	Compressors Service/ Maintenance	Compressors Installation	Wells Service/ Maintenance	Wells Installation	Annual Trips	Ann. Avg. Daily Trips	Avg. Daily Veh. Trips
1997	94,082	-	696,977	-	791,059	2,167	243
1998	94,082	597	696,977	23,401	815,056	2,233	308
1999	96,043	597	732,667	23,401	834,863	2,287	314
2000	98,005	597	768,357	23,401	854,670	2,342	320
2001	99,966	597	804,048	23,401	874,477	2,396	326
2002	101,928	597	839,738	23,401	894,283	2,450	332
2003	103,890	597	875,428	23,401	914,090	2,504	338
2004	105,851	597	911,118	23,401	933,897	2,559	344
2005	107,813	597	946,808	23,401	953,703	2,613	350
2006	109,774	597	982,499	23,401	973,510	2,667	356
2007	111,736	597	1,018,189	23,401	993,317	2,721	362
2008	113,698	-	1,053,879	23,401	1,012,526	2,774	366
2009	113,698	-	1,053,879	23,401	1,030,371	2,823	371
2010	113,698	-	1,053,879	23,401	1,048,216	2,872	376
2011	113,698	-	1,053,879	23,401	1,066,061	2,921	381
2012	113,698	-	1,053,879	23,401	1,083,907	2,970	386
2013	113,698	-	1,053,879	23,401	1,101,752	3,018	391
2014	113,698	-	1,053,879	23,401	1,119,597	3,067	396
2015	113,698	-	1,053,879	23,401	1,137,442	3,116	400
2016	113,698	-	1,053,879	23,401	1,155,287	3,165	405
2017	113,698	-	1,053,879	23,401	1,173,132	3,214	410
2018	113,698	-	1,053,879	-	1,167,577	3,199	351
2019	113,698	-	1,053,879	-	1,167,577	3,199	351
2020	113,698	-	1,053,879	-	1,167,577	3,199	351

Source: BRW, Inc.

TABLE N-7
TOTAL WELL DEVELOPMENT AND SERVICE TRIPS–ALTERNATIVE 3

	No. of Wells		Annual Round Trips per Well by Trip Purpose						Total Trips	
			Drilling	**Comp. and Test**	**Facilities Installation**	**Pipeline Inst.**	**Workover**	**Ops**		
Well Type	*Tribal Minerals*	*Disputed Coal Lands*	*336*	*45*	*31*	*75*	*6*	*365*	**Well Develop-ment**	**Well Service**
Conventional	269	0	90,384	12,105	8,339	20,041	1,614	98,185	230,668	99,799
Coal Bed	367	326	232,848	31,185	21,483	51,629	4,158	252,945	594,248	257,103
Injection	70	52	40,992	5,490	3,782	9,089	732	44,530	104,615	45,262
Total	*706*	*378*		*48,780*	*33,604*	*80,758*	*6,504*	*395,660*	*527,366*	*402,164*
									TOTAL DAILY VEHICLE TRIPS	110

Source: Draft Alternatives Description, Leslie Ellwood, D&M, Facsimile dated 10/24/97; Tiffany EA

TABLE N-8
COMPRESSOR INSTALLATION AND SERVICE TRIP GENERATION ALTERNATIVE 3

Compressor Size (measured in tons NO produced per year)	**Trips Generated**	**Compressor Installation Trips**	**New Sites**	**Service Trips per Site per Year**	**Average Annual Trips**	**Daily Vehicle Trips**
< 50 tons NO per year	0 pick-up visits per week	181	11	-	-	-
	5-7 crew cab visit per week			312	3,432	2
	0.5 multi-axle visits per year			0.5	6	0.00
50 - 100 tons NO per year	0 pick-up visits per week	181	13	-	-	-
	5-7 crew cab visit per week			312	4,056	2
	1 multi-axle visits per year			1	13	0.01
> 100 tons NO per year	2-5 pick-up visits per day	181	17	1,278	21,718	12
	3-8 crew cab visit per month			66	1,122	1
	2 multi-axle visits per year			2	34	0.02
Total Annual Compressor Maintenance Trips Generated on the Southern Ute Reservation					30,380	17
Total New Compressor Installation Trips					7,421	20
Total First year Trips					37,801	37

Source: Dames & Moore, Inc. and BRW, Inc.

TABLE N-9
COMPRESSOR AND WELL ANNUAL TRIPS -ALTERNATIVE 3

	Compressors		Wells				
Year	Service/ Maintenance	Installation	Service/ Maintenance	Installation	Annual Trips	Ann. Avg. Daily Trips	Avg. Daily Veh. Trips
1997	94,082	-	696,977	-	791,059	2,167	243
1998	94,082	742	696,977	26,368	818,169	2,242	317
1999	97,120	742	737,193	26,368	841,315	2,305	324
2000	100,158	742	777,410	26,368	864,461	2,368	331
2001	103,196	742	817,626	26,368	887,608	2,432	338
2002	106,234	742	857,843	26,368	910,754	2,495	345
2003	109,272	742	898,059	26,368	933,900	2,559	353
2004	112,310	742	938,275	26,368	957,046	2,622	360
2005	115,348	742	978,492	26,368	980,192	2,685	367
2006	118,386	742	1,018,708	26,368	1,003,339	2,749	374
2007	121,424	742	1,058,925	26,368	1,026,485	2,812	381
2008	124,462	-	1,099,141	26,368	1,048,889	2,874	386
2009	124,462	-	1,099,141	26,368	1,068,997	2,929	392
2010	124,462	-	1,099,141	26,368	1,089,105	2,984	398
2011	124,462	-	1,099,141	26,368	1,109,213	3,039	403
2012	124,462	-	1,099,141	26,368	1,129,322	3,094	409
2013	124,462	-	1,099,141	26,368	1,149,430	3,149	414
2014	124,462	-	1,099,141	26,368	1,169,538	3,204	420
2015	124,462	-	1,099,141	26,368	1,189,646	3,259	425
2016	124,462	-	1,099,141	26,368	1,209,754	3,314	431
2017	124,462	-	1,099,141	26,368	1,229,863	3,369	436
2018	124,462	-	1,099,141	-	1,223,603	3,352	369
2019	124,462	-	1,099,141		1,223,603	3,352	369
2020	124,462	-	1,099,141	-	1,223,603	3,352	369

Source: BRW, Inc.

APPENDIX O
SUMMARY OF SPACING ORDERS APPLICABLE TO THE SOUTHERN UTE INDIAN RESERVATION

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7076

U.S. Department of the Interior 1849-1999

IN REPLY REFER TO
CO-934
3160

BLM decision from CSO

issued 5/3/00

NOTICE OF DECISION AND ORDER

Well Density;
Fruitland Coal Seams;
Tribal and Individual Indian Allotted Minerals;
Southern Ute Indian Reservation

This constitutes official and formal notice of a decision and order of the Colorado State Office of the Bureau of Land Management (BLM) regarding the density of wells needed to develop Fruitland Formation coal seam gas contained in certain lands located within the exterior boundaries of the Southern Ute Indian Reservation. This decision and order affects oil and gas mineral estates owned by the United States for the benefit of the Southern Ute Indian Tribe (SUIT) or held as individual Indian allotments under the trust protection of the United States. The affected lands are more particularly described in Exhibit A, attached hereto and made a part hereof.

On April 24-25, 2000, the Colorado Oil and Gas Conservation Commission (COGCC) held a consolidated hearing to consider two applications that had been filed in Cause No. 112 (Docket No. 0004-AW-05 and Docket No. 0004-AW-06). Both applications requested that COGCC Order No. 112-61 be amended to allow an optional additional well to be drilled for the production of gas and associated hydrocarbons from the Fruitland Coal Seams for the 320 acre spacing units on all of the lands therein described, including federal, Indian and non-federal lands, rather than one well per 320 acre spacing unit allowed under the pre-existing Order No. 112-61. Docket No. 0004-AW-05 involved lands located north of the Southern Ute Indian Reservation. Docket No. 0004-AW-06 involved lands located within the exterior boundaries of the Southern Ute Indian Reservation.

BLM participated in the COGCC hearing and is issuing this order and decision in accordance with procedures set forth in the Memorandum of Understanding (Southern Ute Indian Tribe and Bureau of Land Management) and Interagency Agreement (Bureau of Indian Affairs and Bureau of Land Management) dated August 22, 1991 (Tribal MOU) and the Memorandum of Understanding between the Colorado Bureau of Land Management and the Colorado Oil and Gas Conservation Commission dated August 22, 1991 (COGCC MOU). Those memoranda of understanding permit the COGCC to conduct evidentiary hearings involving well density on federal and Indian lands and to issue decisions which may be accepted, rejected or modified by the

BLM to the extent they affect federal and Indian lands. With respect to tribal lands, in accordance with the Tribal MOU, the SUIT provided BLM with its consent and concurrence for this matter to be heard by the COGCC, and the BLM notified the COGCC of this agency's consent for the matter to proceed.

Based upon the testimony and evidence presented, on April 25, 2000, the COGCC found that as to the lands described in both applications, it is necessary to allow the drilling of an optional additional well per 320 acre spacing unit in order to recover coal seam gas from the Fruitland Formation. In accordance with its procedures, COGCC entered an order amending Order No. 112-61 to conform to its findings; however, as to all non-federal and non-Indian oil and gas estates, the COGCC stayed the effect of its order pending the completion of a public issues hearing to be conducted subsequently. For reasons more fully explained below, the COGCC public issues hearing does not apply to the federal and Indian lands contained in the two applications.

In order to eliminate any possible confusion regarding the effect of the COGCC's decision as it relates to Indian lands described in Docket No. 0004-AW-06, the BLM hereby orders that effective as of the date of this Notice of Decision and Order, with respect to the lands described in Exhibit A, the permissible well density for Fruitland Formation coal seam gas wells is two wells per 320 acre spacing unit. In support of this decision, the uncontroverted evidence presented at the COGCC hearing was that the drilling of one well per 320 acre drilling unit was not sufficient to recover all reserves. Additionally, the uncontroverted evidence was that the drilling of one additional well per 320 acre spacing unit would be consistent with the efficient and prudent recovery of the coal seam gas resources. Prior to the COGCC's hearing, representatives of the applicants had presented information to the BLM supporting their applications. BLM mineral staff reviewed the reservoir data and concluded, through an independent analysis of the data, that an additional well per 320 acre spacing unit is needed for recovery of the resource. The sworn testimony and evidence received at the COGCC hearing revealed nothing that contravened the previous presentations provided to the BLM, and the BLM concurs with the findings of the COGCC.

The BLM's trust responsibility to the SUIT and Indian allottees also supports entry of this order. The technical staffs of both the BLM and the SUIT have conferred, and they share the view that additional infill drilling is needed to develop the Tribe's coal seam gas resources prudently. If additional development proceeds, the SUIT will benefit not only from accelerated income, but also from a sizeable incremental increase in revenue associated with resources that would otherwise not be recovered in any foreseeable fashion.

BLM also wants to emphasize, however, that entry of this order will not result directly in the drilling of any additional wells, and entry of this order will not have any environmental impact. To the contrary, this order confirms that economically and from an oil and gas resource management perspective, the change in well spacing is justified. Prior to any additional drilling proceeding on Indian lands, lessees or designated operators shall be required to apply for and

obtain permits to drill from the BLM. In reviewing any such application or group of applications, the BLM shall evaluate the environmental consequences of permitting additional drilling in conformity with the requirements of the National Environmental Policy Act ("NEPA"). In that regard it should be noted that since 1995 this agency, in conjunction with the Bureau of Indian Affairs and the Tribe, has been preparing a nearly completed Environmental Impact Statement with respect to increased density oil and gas development on Indian lands within the Reservation. Decisions to grant or deny applications for permits to drill, or to condition approval based upon necessary environmental impact mitigation measures, shall include additional evaluation under NEPA. This agency has significant legal duties associated with its Indian trust responsibility, as well as, obligations under NEPA and other federal statutes. The evaluation and balancing of those duties cannot be shifted to other agencies or to the COGCC.

The COGCC is not bound by NEPA with respect to oil and gas development on private lands. At the COGCC public issues hearing to be held in the near future regarding these applications, testimony will be taken regarding health, safety, and environmental issues associated with these applications. As recognized by the COGCC, with respect to federal and Indian lands, the BLM is the agency that must address these matters, and the COGCC has agreed to not impose development conditions upon the lessees who have obtained their interests pursuant to federal statutory authority. Because the COGCC is not bound by the same responsibilities of the BLM and has agreed to not impose conditions upon the development of federal and Indian lease operations, federal and Indian lands shall not be subject to the COGCC's determinations resulting from the public issues hearing. Nonetheless, the BLM shall carefully review and consider any conclusions the COGCC reaches under that process.

If you wish to contest this decision, you may appeal to the Interior Board of Land Appeals (See 43 CFR 3165.4 and 43 CFR Part 4). Information regarding the appeals process is attached. Please note that this decision addresses only the technical aspects of efficient drainage of reservoirs, *i.e.*, conservation of the resource and correlative rights. Therefore, any appeals of this decision must specifically address those issues. This decision does not and, indeed, could not address the environmental impacts of allowing the drilling of additional wells. The environmental impacts of drilling any additional wells will be addressed in the appropriate, site-specific environmental analysis which will be done in connection with an actual Application for Permission to Drill. Appeals of decisions on those APD's, including the environmental impacts of lesser spacing, may be addressed at that time. Information regarding the appeals process is attached.

This decision and order is entered this 3rd day of May, 2000.

Jenny L. Saunders

Jenny L. Saunders, Acting Deputy State Director

Exhibit A (Lands South of the Ute Line)

T.32N., R.5W., N.M.P.M.: Sections 5-8 All, Sections 17-20 All

T.32N., R.6W., N.M.P.M.: Sections 1-4 All, Section 5 N1/2, Section 7 E1/2,Section 8 E1/2, Sections 9-16 All, Section 17 E1/2, Section 18 All, Section 23 All, Section 24 All

T.32N., R.7W., N.M.P.M.: Sections 3-6 All, Section 7 E1/2, Sections 8-11 All, Sections 13-17 All, Section 19 E1/2E1/2, Sections 20-22 All, Section 23 W1/2;W1/2E1/2

T.33N., R.7W., N.M.P.M.: Sections 1-7 All, Section 8 E1/2, Sections 9-11 All, Section 12 N1/2, Section 14 W1/2, Sections 15-23 All, Section 25 All, Section 26 W1/2, Sections 27-34 All, Section 35 W1/2, Section 36 N1/2

T.33N., R.8W., N.M.P.M. Sections 1-18 All, Section 19 N1/2, Section 20 N1/2, Sections 21-27 All, Section 35 N1/2, Section 36 All

T.33N., R.9W., N.M.P.M. Sections 1-2 All, Section 3 N1/2, Sections 4-15 All, Section 16 E1/2, Sections 17-24 All, Section 29 W1/2, Section 30 All, Section 31 N1/2, Section 32 W1/2

T.33N., R.10W., N.M.P.M. Sections 1-6 All, Section 10 All, Section 11 E1/2, Section 12 All, Section 14 W1/2, Section 15 All, Section 16 All, Section 20 E1/2, Section 21 W1/2

T.33N., R.11W., N.M.P.M. Section 1 E1/2, Section 13 N1/2, Section 14 All

T.34N., R.7W., N.M.P.M.(SUL) Sections 1-9 All, Section 10 E1/2, Sections 11-36 All

T.34N., R.8W., N.M.P.M.(SUL) Sections 1-15 All, Section 16 S1/2, Section 17 All, Section 18 All, Section 19 W1/2, Sections 20-22 All, Section 23 S1/2, Section 24 All, Sections 25-28 All, Section 29 E1/2, Sections 30-36 All

T.34N., R.9W., N.M.P.M.(SUL) Sections 1-11 All, Sections 13-35 All

T.34N., R.10W., N.M.P.M.(SUL) Section 1 All, Section 12 All, Section 13 All, Section 14 S1/2, Sections 22-36 All

Form 1840-6
(July 1996)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

INFORMATION ON TAKING APPEALS TO THE BOARD OF LAND APPEALS

DO NOT APPEAL UNLESS
1. This decision is adverse to you,
AND
2. You believe it is incorrect.

IF YOU APPEAL, THE FOLLOWING PROCEDURES MUST BE FOLLOWED

1. NOTICE OF APPEAL	Within 30 days file a Notice of Appeal in the office which issued this decision (see 43 CFR 4.411 and 4.413). You may state your reasons for appealing, if you desire.
2. WHERE TO FILE NOTICE OF APPEAL	BUREAU OF LAND MANAGEMENT RESOURCE SERVICES (CO-934) 2850 YOUNGFIELD STREET LAKEWOOD, COLORADO 80215
WITH COPY TO SOLICITOR	REGIONAL SOLICITOR ROCKY MOUNTAIN REGION 755 PARFET STREET, SUITE 151 LAKEWOOD, COLORADO 80215
WITH COPY TO BOARD OF LAND APPEALS	DEPARTMENT OF THE INTERIOR BOARD OF LAND APPEALS 4015 WILSON BLVD. ARLINGTON, VIRGINIA 22203
3. STATEMENT OF REASONS	Within 30 days after filing the Notice of Appeal, file a complete statement of the reasons you are appealing. This must be filed with the Interior Board of Land Appeals, at the above address (see 43 CFR 4.412 and 4.413). If you fully stated your reasons for appealing when filing the Notice of Appeal, no additional statement is necessary. Copies of your statement of reasons must be filed with the Solicitor at the above address.
4. ADVERSE PARTIES	Within 15 days after each document is filed, each adverse party named in the decision and the Regional Solicitor or Field Solicitor having jurisdiction over the State in which the appeal arose must be served with a copy of: (a) the Notice of appeal, (b) the Statement of Reasons, and (c) any other documents filed (see 43 CFR 4.413).

5. PROOF OF SERVICE

Within 15 days after any document is served on an adverse party, file proof of that service with the Interior Board of Land Appeals. This may consist of a certified or registered mail "Return Receipt Card" signed by the adverse party (see 43 CFR 4.401(c)).

6. REQUEST FOR STAY

Except where program-specific regulations place this decision in full force and effect or provide for an automatic stay, the decision becomes effective upon the expiration of the time allowed for filing an appeal unless a petition for stay is timely filed (see 43 CFR 4.2[illegible] you wish to file a petition for a stay of the effectiveness of this decision during the time that your appeal is being reviewed by the Board, the petition for a stay must accompany your notice of appeal. A petition for a stay is required to show sufficient justification based on the standards listed below. Copies of the notice of appeal and petition for a stay must also be submitted to each party named in this decision and to the Interior Board of Land Appeals and the appropriate Office of the Solicitor (see 43 CFR 4.413) at the same time the original documents are filed with this office. If you request a stay, you have the burden of proof to demonstrate that a stay should be granted.

STANDARDS FOR OBTAINING A STAY

Except as otherwise provided by law or other pertinent regulation, a petition for a stay of a decision pending appeal shall show sufficient justification based on the following standards:

(1) The relative harm to the parties if the stay is granted or denied,

(2) The likelihood of the appellant's success on the merits,

(3) The likelihood of immediate and irreparable harm if the stay is not granted, and

(4) Whether the public interest favors granting the stay.

Unless these procedures are followed, your appeal will be subject to dismissal (see 43 CFR 4.402). Be certain that all communications are identified by serial number of the case being appealed.

SUBPART 1821.2–OFFICE HOURS; TIME AND PLACE FOR FILING

Sec. 1821.2-1 *Office hours of State Office.* (a) State Offices and the Washington Office of the Bureau of Land Management are open to the public for the filing of documents and inspection of records during the hours specified in the paragraph on Monday through Friday of each week with the exception of those days where the office may be closed because of a national holiday or Presidential or other administrative order. The hours during which the State Offices and the Washington Office are open to the public for the filing of documents and inspection of records are from 10 a.m. to 4 p.m. standard time or daylight saving time, whichever is in effect at the city in which each office is located.

Sec. 1821.2-2(d) Any document required or permitted to be filed under the regulations of this chapter, which is filed under the regulations of this chapter, which is received in the State Office or the Washington Office, either in the mail or by personal delivery when the office is not open to the public shall be deemed to be filed as of the day and hour the office next opens to the public.

(e) Any document required by law, regulation, or decision to be filed within a stated period, the last day of which falls on a day the office is officially closed, shall be deemed to be timely filed if it is received in the appropriate office on the next day the office is open to the public.

IN THE MATTER OF THE PROMULGATION AND ESTABLISHMENT OF FIELD RULES TO GOVERN OPERATIONS IN THE IGNACIO-BLANCO FIELD, LA PLATA AND ARCHULETA COUNTIES, COLORADO

Cause No. 112 Order No. 112-157

REPORT OF THE COMMISSION

This cause came on for hearing before the Commission on April 24, 2000 in the Boettcher Auditorium, Colorado History Museum, 1300 Broadway, Denver, Colorado, on April 25, 2000 in Suite 801, 1120 Lincoln Street, Denver, Colorado, on June 5 and 6, 2000 in the Exhibit Hall, La Plata County Fairgrounds, 2500 Main Avenue, Durango, Colorado and on July 10 and 11, 2000 in Suite 801, 1120 Lincoln Street, Denver, Colorado on the verified application of Amoco Pro duction Company, the Southern Ute Indian Tribe, d/b/a Red Willow Production Company, J.M. Huber Corporation, Hallwood Petroleum, Inc., SG Interests I, Ltd., Four Star Oil & Gas Company, Vastar Resources, Inc., EnerVest San Juan Operating, LLC, Pablo Operating Company, Petrogulf Corporation, Elm Ridge Resources, Maralex Resources, Inc., and Don Gosney for an order from the Commission to allow an optional additional well to be drilled for production of gas from the Fruitland Coal seams for certain 320-acre drilling and spacing units in the Ignacio-Blanco Field.

SUMMARY OF PROCEEDINGS

1. Amoco Production Company, the Southern Ute Indian Tribe, d/b/a Red Willow Production Company, J.M. Huber Corporation, Hallwood Petroleum, Inc., SG Interests I, Ltd., Four Star Oil & Gas Company, Vastar Resources, Inc., EnerVest San Juan Operating, LLC, Pablo Operating Company, Petrogulf Corporation, Elm Ridge Resources, Maralex Resources, Inc., and Don Gosney, as applicants herein, are interested parties in the subject matter of the above-referenced hearing.

2. Due notice of the time, place and purpose of the hearing has been given in all respects as required by law.

3. The Commission has jurisdiction over the subject matter embraced in said Notice, and of the parties interested therein, and jurisdiction to promulgate the hereinafter prescribed order pursuant to the Oil and Gas Conservation Act and the terms of the Memorandum of Understanding ("MOU") between the Commission and the Bureau of Land Management ("BLM").

4. On June 15, 1988, the Commission issued Order No. 112-60 which established 320-acre drilling and spacing units for the production of gas from the Fruitland coal seams, underlying certain lands in the Ignacio-Blanco Field, with the units to consist of a governmental half section and the permitted well when north of the north line of Township 32 North to be located in the NW1/4 and the SE1/4 of each section and when south of the north line of Township 32 North to be located in the NE1/4 and SW1/4 of each section, no closer than 990 feet from the boundaries of the quarter section, nor closer than 130 feet to any interior quarter section line. Order Nos. 112-61 and 112-85 were subsequently adopted amending Order No. 112-60 to establish additional field rules for the Fruitland coal seams.

5. On March 6, 2000 Amoco Production Company, the Southern Ute Indian Tribe, d/b/a Red Willow Production Company, J.M. Huber Corporation, Hallwood Petroleum, Inc., SG Interests I, Ltd., Four Star Oil & Gas Company, Vastar Resources, Inc., EnerVest San Juan Operating, LLC, Pablo Operating

Company, Petrogulf Corporation, Elm Ridge Resources, Maralex Resources, Inc., and Don Gosney ("Applicants"), by and through their attorneys, filed with the Commission a single application requesting an order from the Commission to allow an optional additional well to be drilled for production of gas from the Fruitland coal seams for certain 320-acre drilling and spacing units in the Ignacio-Blanco Field.

6. On March 7, 2000 the Applicants by and through their attorneys, filed with the Commission a revised application to separate the lands north of the Ute Line from those south of the Ute Line, requesting an order from the Commission to allow an optional additional well to be drilled for production of gas from the Fruitland Coal seams for the 320-acre drilling and spacing units described below, with the permitted well to be located in any undrilled quar ter section no closer than 990 feet from the boundaries of the quarter section, nor closer than 130 feet to any interior quarter section line.

Township 32 North, Range 5 West, N.M.P.M. Sections 5 thru 8: All Sections 17 thru 20: All

Township 32 North, Range 6 West, N.M.P.M. Sections 1 thru 4: All Section 5: N1/2 Section 7: E1/2 Section 8: E1/2 Sections 9 thru 16: All Section 17: E1/2 Section 18: All Section 23: All Section 24: All

Township 32 North, Range 7 West, N.M.P.M. Sections 3 thru 6: All Section 7: E1/2 Sections 8 thru 11: All Sections 13 thru 17: All Section 19: E1/2 E1/2 Sections 20 thru 22: All Section 23: W1/2; W1/2 E1/2

Township 33 North, Range 7 West, N.M.P.M. Sections 1 thru 7: All Section 8: E1/2 Sections 9 thru 11: All Section 12: N1/2 Section 14: W1/2 Sections 15 thru 23: All Section 25: All Section 26: W1/2 Sections 27 thru 34: All Section 35: W1/2 Section 36: N1/2

Township 33 North, Range 8 West, N.M.P.M. Sections 1 thru 18: All Section 19: N1/2 Section 20: N1/2 Sections 21 thru 27: All Section 35: N1/2 Section 36: All

Township 33 North, Range 9 West, N.M.P.M. Sections 1 and 2: All Section 3: N1/2 Sections 4 thru 15: All Section 16: E1/2 Sections 17 thru 24: All Section 29: W1/2 Section 30: All Section 31: N1/2 Section 32: W1/2

Township 33 North, Range 10 West, N.M.P.M. Sections 1 thru 6: All Section 10: All Section 11: E1/2 Section 12: All Section 14: W1/2 Section 15: All Section 16: All Section 20: E1/2 Section 21: W1/2

Township 33 North, Range 11 West, N.M.P.M. Section 1: E1/2 Section 13: N1/2 Section 14: All

Township 34 North, Range 7 West, N.M.P.M. (S.U.L.) Sections 1 thru 9: All Section 10: E1/2 Sections 11 thru 36: All

Township 34 North, Range 8 West, N.M.P.M. (S.U.L.) Sections 1 thru 15: All Section 16: S1/2 Section 17: All Section 18: All Section 19: W1/2 Sections 20 thru 22: All Section 23: S1/2 Section 24: All Sections 25 thru 28: All Section 29: E1/2 Sections 30 thru 36: All

Township 34 North, Range 9 West, N.M.P.M. (S.U.L.) Sections 1 thru 11: All Sections 13 thru 35: All

Township 34 North, Range 10 West, N.M.P.M. (S.U.L.) Section 1: All Section 12: All Section 13: All Section 14: S1/2 Sections 22 thru 36: All

7. On April 4, 2000 a Local Public Forum on the application was held in Ignacio to consider potential issues related to the environment, public health, safety and welfare. At the April 24, 2000 hearing all

Commissioners verified that they had viewed the videotapes of the Local Public Forum.

8. On April 4, 2000, the Tribal Council of the Southern Ute Indian Tribe submitted a letter to the Commission in support of the application.

9. Pursuant to Rule 527., Colorado Oil and Gas Conservation Commission ("COGCC") staff convened a prehearing conference on April 12, 2000. Because La Plata County ("County") intervened in the application, under Rule 508.i.(4) a Public Issues Hearing must be held. After hearing arguments and discussion, the COGCC Hearing Officer made a preliminary ruling that the technical hearing would be bifurcated from consideration of the environmental and public health, safety and welfare issues raised by the County and the protestants to the Public Issues Hearing.

10. On April 24, 2000 the BLM submitted a letter to the Commission in support of the Application for the federal lands in accordance with the conditions of the Memorandum of Understanding between the BLM and the Commission.

BOWEN/EDWARDS/DURANGO PROTEST/INTERVENTION

11. On April 10, 2000 Bowen Gas Corporation, Edwards Energy Corporation and Durango Corporation (collectively, "Bowen") filed with the Commission a protest to the application seeking the inclusion of certain additional lands into the application. On April 14, 2000, Bowen filed with the Commission a withdrawal of their protest.

TIMOTHY BLAKE PROTEST/INTERVENTION

12. On April 10, 2000 Timothy Blake filed with the Commission a protest to the application. On April 23, 2000 Timothy Blake filed with the Commission via facsimile a request to continue the hearing for a minimum of two (2) weeks and to hold the technical hearing in Durango. Mr. Blake did not appear at the April hearing. His motion was denied.

LA PLATA COUNTY PROTEST/INTERVENTION

13. On April 10, 2000 La Plata County filed with the Commission a Statement in Protest and Intervention to the application, to raise issues relating to impacts on the environment and on public health, safety and welfare arising out of the application. The County intervenes by right pursuant to Rule 509.a.

14. On April 11, 2000 the County filed with the Commission a Motion for Expedited Discovery and a First Set of Interrogatories and Request for Production of Documents. The motion was mooted by the Applicants' agreement, stated at the Prehearing Conference, to provide the requested materials to the County.

15. On April 17, 2000 the County filed with the Commission a Motion to Hold Public Issues Hearing in Durango, Colorado. At the hearing, the Commission granted that motion.

SAN JUAN CITIZENS ALLIANCE PROTEST

16. On April 10, 2000 the San Juan Citizens Alliance ("Alliance") filed with the Commission a protest to the application and in the alternative sought to intervene on various procedural and substantive grounds.

17. On April 12, 2000 the Alliance filed with the Commission a Motion to Cancel and Reschedule the

Preconference Hearing.

18. On April 17, 2000 the Alliance filed with the Commission a Motion to Strike and Dismiss. At the hearing on April 24, 2000, the Commission denied the Motion to Strike, finding that the application contained sufficient information, and denied the Motion to Dismiss finding that the Applicants have standing to bring the application before the Commission.

19. At the hearing on April 24, 2000 the Alliance requested the Commission grant a continuance to the June hearing on the grounds that inadequate notice was given of the Prehearing Conference. The Commission denied the Motion to Continue.

20. At the April hearing the Alliance raised their concern on bifurcation of the environmental and public health, safety and welfare issues to the Public Issues Hearing. The Commission confirmed the preliminary ruling by the COGCC Hearing Officer that the technical hearing would be bifurcated from consideration of the environmental and public health, safety and welfare issues.

APPLICANTS' MOTION

21. At the April hearing the Applicants made a Motion to Dismiss the Protests of the Alliance and Timothy Blake and to determine the status of all the parties. The Applicants argued that Mr. Blake should not be granted party status for this application as the lands he has a direct interest in are located north of the Ute Line. The Commission granted the Alliance intervenor status in both the technical hearing and the Public Issues Hearing. When the Commission voted on Mr. Blake's participation, it was unclear as to which lands he was granted intervenor status on for purposes of the Public Issues Hearing.

STAFF ANALYSIS

22. At the April hearing the Director testified that based on a review of adjacent pilot projects and on the La Plata County Development Plan prepared by COGCC staff, an additional well is necessary to be drilled on the 320-acre drilling and spacing units subject to the application in order to efficiently and economically recover gas from the Fruitland coal seams. The Director also testified that independent staff analysis of the Applicants' economic analysis confirmed the Applicants' rate of return calculations.

23. The Director recommended that any order granting the application provide for the Director, at the Director's discretion, to attach drilling permit conditions to require the acquisition and reporting of initial measured bottom hole pressures. Such pressures would be obtained utilizing a bottom hole gauge after a minimum forty-eight (48) hour shut-in period following completion and prior to sales.

TECHNICAL EVIDENCE

24. The Commission heard expert testimony from Gary Weitz, Landman for Amoco Production Company regarding ownership of the land in the Application Area who testified that there are four hundred seventy-six (476) possible well locations within the Application Area and that the program is expected to take between five (5) and ten (10) years to complete.

25. The Commission heard expert testimony from W.C. Rusty Riese, Consulting Geologist for Vastar Resources, Inc. regarding the geologic development in the area, who opined that the Fruitland coal seams are discontinuous across the Application Area and that granting the application would minimize waste and maximize production from the Fruitland coal seams.

26. The Commission heard expert testimony from J.W. (Bill) Hawkins, Regulatory Affairs Engineer for Amoco Production Company regarding the production and drainage of the Fruitland coal seams in the Application Area. Mr. Hawkins opined that additional wells were appropriate to prevent waste and maximize production. Mr. Hawkins further testified that the drilling of additional wells would be economic for the Applicants.

27. The Commission heard expert testimony from Vu Dinh, Principal Reservoir Engineer for Vastar Resources, Inc. on infill wells from the Fruitland coal seams reservoir regarding production, drainage and reservoir pressure. Mr. Dinh opined that additional wells would recover additional reserves, protect correlative rights and prevent waste within the Application Area.

28. Based on the technical testimony presented by the Applicants the Commission found that one well will not efficiently and economically drain the drilling and spacing units previously designated by the Commission, and that based on geological and engineering data presented at the hearing, additional wells are necessary to allow the gas to be produced at its maximum efficient rate, to prevent waste and protect correlative rights, and to efficiently an d economically recover gas from the Fruitland coal seams within the Application Area.

PUBLIC COMMENT/PARTICIPATION

29. Letters, e-mails or telephone contacts in opposition to the application were received from sixty-three (63) La Plata County residents.

30. Letters in support of the application were received from five (5) La Plata County residents.

31. Pursuant to Rule 510., La Plata County officials Mike Matheson, Joe Crain, Josh Joswick made statements regarding the need to consider potential impacts to the environment, public health, safety and welfare issues at a Public Issues Hearing in Durango that might occur if the application is granted.

32. Pursuant to Rule 510., Billy Ray Clary, a mineral owner in La Plata County, made statements regarding issues not within the scope of the application and was directed to handle those concerns at another hearing if warranted.

33. Pursuant to Rule 510., Ken Wonstolen of the Colorado Oil & Gas Association made statements regarding the increasing demand for natural and the issue of "balance" related to developing resources while protecting the environment, public health, safety and welfare.

34. Based on the facts stated in the application and the testimony and exhibits presented by the Applicants at the April Hearing, the Commission finds that the request to allow an optional additional well on the 320-acre drilling and spacing units for production of gas from the Fruitland coal seams for the lands described in Finding #6 in the Ignacio-Blanco Field should be approved. The permitted well shall be located in any undrilled quarter section, no closer than 990 feet from the boundaries of the quarter section, nor closer than 130 feet to any interior quarter section line.

35. On April 25, 2000 upon conclusion of the hearing, a BLM representative stated concurrence with the Commission's decision and clarified the BLM's position that federal and tribal lands were not subject to the Public Issues Hearing.

PUBLIC ISSUES HEARING

36. The Commission convened a Public Issues Hearing in Durango on June 5 and 6, 2000.

37. A motion was made by the Alliance to admit the videotapes from the April 4, 2000 Local Public Forum into the record. The Commission Chair granted the motion.

38. A motion was made by the Alliance to allow more time for the submission of written Rule 510. statements. The Commission Chair denied the motion.

39. A motion was made by the County to retain the court reporter and allow citizens to make verbal 510. statements after the Commission had left Durango. The Commission Chair denied the motion.

40. A motion was made by the Applicants to deny admission of the Alliance's witnesses based on failure to receive witnesses' resumes by the due date. The Commission Chair denied the motion.

41. The Commission continued the Public Issues Hearing in Denver on July 10 and 11, 2000.

42. A motion was made by the County to reallocate the allotted presentation times of the Intervenors. The Commission Chair granted the motion.

43. A motion was made by the Alliance to strike the Rule 510. written statement submitted by Scott Zimmerman. The Commission denied the motion.

STAFF ANALYSIS

44. At the June hearing the Director requested the admission of three documents into the record and testified that based on the information contained within along with the Applicants' proposed environment, public health, safety and welfare plan the environment, public health, safety and welfare were adequately protected from increased density wells. He further testified that site-specific conditions are the most appropriate to attach to each Applicati on for Permit-to-Drill. In addition, the Director reiterated the condition he recommended to the Commission at the April hearing to require periodic post-production pressure build-up data to be provided by operators.

45. At the July hearing the Director presented and discussed a memorandum to the Commission containing staff's proposed version of the Applicants' environment, public health, safety and welfare plan along with staff's proposed Rule 508.j.(3)B. Conditions. In addition, a memorandum from Debbie Baldwin to the Director was attached regarding clinker and abandoned coal mines associated with the Fruitland coal seams.

APPLICANTS EVIDENCE

46. The Commission heard expert testimony from David Brown, Environmental Specialist for Amoco Production Company regarding the Applicants' proposed plan to protect the environment, public health, safety and welfare who testified that, along with the Commission's existing rules, the proposed plan would ensure protection of the environment, public health, safety and welfare from increased density wells.

47. The Commission heard expert testimony from Alexander McLean, Vice President of Engineering and Acquisitions for SG Interests regarding bradenhead testing, types of pumping units, fracing of wells, cavitation and other operational issues. Mr. McLean opined that the proposed plan would adequately protect the environment, public health, safety and welfare.

48. On June 20, 2000 written supplemental testimony was submitted by David Brown regarding the Applicants' proposed environment, public health, safety and welfare plan.

49. On June 20, 2000 written supplemental testimony was submitted by Alexander McLean regarding toxicity, rights-of-way and cement integrity behind casing.

50. On June 26, 2000 written rebuttal testimony was submitted by W.C. Rusty Riese in response to Warren Holland's testimony regarding drainage by gas wells of water in the outcrop area, gas seepage, coal fires and contamination of water wells.

51. On June 26, 2000 written rebuttal testimony was submitted by Tamara Joslin outlining the differences between the Applicants' proposed plan and the County's proposed plan.

52. On June 26, 2000 written rebuttal testimony was submitted by Thomas Murphy regarding La Plata County coalbed methane outcrop evaluation.

53. On June 26, 2000 written rebuttal testimony was submitted by Daryl Erickson in response to Warren Holland's testimony regarding the Hickerson Hot Spring.

54. On June 26, 2000 written rebuttal testimony was submitted by Constance Heath regarding certain provisions in the County's proposed environment, public health, safety and welfare plan.

TIMOTHY BLAKE EVIDENCE

55. The Commission heard expert testimony from Robert Suenram, Realtor regarding the effects of wells on property values, who opined that the presence of wells along with their visual and noise impacts adversely affects real estate sales and purchases.

56. The Commission heard expert testimony from Robert McGrath, M.D. regarding pediatric safety who opined that impacts from wells on children may result in injury or death. The Applicants objected to this witness.

57. The Commission heard fact testimony from Lori Kelly who described the stress she experiences from gas well operations.

58. The Commission heard expert testimony from Deanna Surprenant, LCSW regarding the effects of stress on people where they have no control over a situation. The Applicants objected to this witness.

59. The Commission heard expert testimony from Richard Grossman, M.D. regarding the impact of gas wells on people and the environment. Dr. Grossman expressed concern about the availability of gas for future generations.

60. The Commission heard fact testimony from William Morris who testified that his water well goes bad for several days each time gas wells are fractured.

61. The Commission heard fact testimony from Mac Burkett who described the stress gas operations have had on her and treatment she has undergone for depression and anxiety.

62. The Commission heard fact testimony from Mark Brown who described the stress he has endured from gas operations near his home over the past ten (10) months.

SAN JUAN CITIZENS ALLIANCE EVIDENCE

63. The Commission heard expert testimony from Dale Lehman, Economics Professor regarding the lack of data provided to the Commission to determine cost-effectiveness and economic need for additional wells. Mr. Lehman testified about guidelines for economic analysis for infill development.

64. The Commission heard expert testimony from Wilma Subra, Biologist regarding potential impacts from increased well density on the environment and disposition of oilfield waste.

65. The Commission heard fact testimony from Jane Dryer regarding the presence of combustible gas in her home and possible health effects on her child.

66. The Commission heard expert testimony from Jim Fitzgerald, Sociology Professor regarding the importance of stories told by the public who opined that the application was not sufficient to address public welfare.

LA PLATA COUNTY EVIDENCE

67. The Commission heard expert testimony from David Cox regarding the data used and results obtained in the 3M Coalbed Methane Reservoir Model he prepared. He opined that the model showed no impact from increased well density.

68. The Commission heard expert testimony from Warren Holland, Engineer and Oil and Gas Technical Advisor to the County regarding the significant adverse environmental impacts he believes may result from increased well density. He further testified as to the plan proposed by the County and opined that it would adequately address the environment, public health, safety and welfare issues.

69. The Commission heard expert testimony from Adam Keller, La Plata County Planner and Local Governmental Designee regarding the County's proposal to require operators to provide annual drilling plans to the County that could be distributed to affected surface owners.

70. On June 20, 2000 written supplemental testimony was submitted by Adam Keller clarifying the County's proposed environment, public health, safety and welfare plan.

71. On June 20, 2000 written direct testimony was submitted by Joe Crain supporting the County's proposed environment, public health, safety and welfare plan.

72. On June 20, 2000 written direct testimony was submitted by Josh Joswick supporting the County's proposed environment, public health, safety and welfare plan.

PUBLIC COMMENT/PARTICIPATION

73. Pursuant to Rule 510., thirty-one (31) citizens of La Plata County made statements regarding potential impacts to the environment, public health, safety and welfare at the June hearing.

74. Pursuant to Rule 510., written statements were filed by or on June 10, 2000 by thirty-four (34) citizens regarding potential impacts to the environment, public health, safety and welfare. All of these statements except those without signatures were admitted into the record.

FINDINGS

75. Based on the testimony and exhibits presented at the June and July Public Issues Hearing and pursuant to Rule 508.j.(3), the Commission finds it necessary to apply conditions to the order to protect the environment from significant adverse impacts and to protect the public health, safety, and welfare, except as to those lands included in the BLM's Notice of Decision and Order dated May 3, 2000.

ORDER

NOW, THEREFORE, IT IS ORDERED, that Order Nos. 112-60, 112-61 and 112-85 are hereby amended to allow an optional additional well to be drilled for production of gas from the Fruitland Coal seams for the 320-acre drilling and spacing units described below, with the permitted well to be located in any undrilled quarter section no closer than 990 feet from the boundaries of the quarter section, nor closer than 130 feet to any interior quarter section line.

Township 32 North, Range 5 West, N.M.P.M. Sections 5 thru 8: All Sections 17 thru 20: All

Township 32 North, Range 6 West, N.M.P.M. Sections 1 thru 4: All Section 5: N1/2 Section 7: E1/2 Section 8: E1/2 Sections 9 thru 16: All Section 17: E1/2 Section 18: All Section 23: All Section 24: All

Township 32 North, Range 7 West, N.M.P.M. Sections 3 thru 6: All Section 7: E1/2 Sections 8 thru 11: All Sections 13 thru 17: All Section 19: E1/2 E1/2 Sections 20 thru 22: All Section 23: W1/2; W1/2 E1/2

Township 33 North, Range 7 West, N.M.P.M. Sections 1 thru 7: All Section 8: E1/2 Sections 9 thru 11: All Section 12: N1/2 Section 14: W1/2 Sections 15 thru 23: All Section 25: All Section 26: W1/2 Sections 27 thru 34: All Section 35: W1/2 Section 36: N1/2

Township 33 North, Range 8 West, N.M.P.M. Sections 1 thru 18: All Section 19: N1/2 Section 20: N1/2 Sections 21 thru 27: All Section 35: N1/2 Section 36: All

Township 33 North, Range 9 West, N.M.P.M. Sections 1 and 2: All Section 3: N1/2 Sections 4 thru 15: All Section 16: E1/2 Sections 17 thru 24: All Section 29: W1/2 Section 30: All Section 31: N1/2 Section 32: W1/2

Township 33 North, Range 10 West, N.M.P.M. Sections 1 thru 6: All Section 10: All Section 11: E1/2 Section 12: All Section 14: W1/2 Section 15: All Section 16: All Section 20: E1/2 Section 21: W1/2

Township 33 North, Range 11 West, N.M.P.M. Section 1: E1/2 Section 13: N1/2 Section 14: All

Township 34 North, Range 7 West, N.M.P.M. (S.U.L.) Sections 1 thru 9: All Section 10: E1/2 Sections 11 thru 36: All

Township 34 North, Range 8 West, N.M.P.M. (S.U.L.) Sections 1 thru 15: All Section 16: S1/2 Section 17: All Section 18: All Section 19: W1/2 Sections 20 thru 22: All Section 23: S1/2 Section 24: All Sections 25 thru 28: All Section 29: E1/2 Sections 30 thru 36: All

Township 34 North, Range 9 West, N.M.P.M. (S.U.L.) Sections 1 thru 11: All Sections 13 thru 35: All

Township 34 North, Range 10 West, N.M.P.M. (S.U.L.) Section 1: All Section 12: All Section 13: All Section 14: S1/2 Sections 22 thru 36: All

IT IS FURTHER ORDERED, that the following shall be applied to additional wells where the surface location is proposed to be sited on lands subject to Commission jurisdiction, in addition to any requirements of applicable existing Commission Rules and Regulations:

Well Permit Limitations A Commission hearing shall be required before a drilling permit may be issued for a well site located within one and one-half (11/2) miles of the outcrop contact between the Fruitland and Pictured Cliffs Formations. The purpose of the hearing shall be to address potential adverse impacts to the Fruitland outcrop.

Water Well Sampling The Director shall apply appropriate drilling permit conditions to require water well sampling near proposed additional wells. The following shall be used as guidance for the Director in establishing permit conditions requiring water well sampling:

If a conventional gas well exists within one quarter (1/4) mile of a proposed additional well, then the two (2) closest water wells within a one-half (1/2) mile radius shall be sampled ("water quality testing wells"). Ideally, if possible, the water wells selected should be on opposite sides of the existing conventional gas well not exceeding a one-half (1/2) mile radius. If water wells on opposite sides of the conventional gas well cannot be identified , then the two (2) closest wells within a one-half (1/2) mile radius shall be sampled. If two (2) or more conventional wells are located within one quarter (1/4) mile of the proposed additional well, then the conventional well closest to a proposed additional well shall be used for selecting water wells for sampling.

If no conventional gas wells are located within a one quarter (1/4) mile radius of the proposed additional well, then the selected water wells shall be within one quarter (1/4) mile of the proposed additional well. In areas where two (2) or more water wells exist within one quarter (1/4) mile of the proposed additional well, then the two (2) closest water wells shall be sampled. Ideally, if possible, the water wells selected should be on opposite sides of the proposed additional well. If water wells on opposite sides of the proposed additional well cannot be identified, then the two (2) closest wells within a one quarter (1/4) mile radius shall be sampled. If two (2) water wells do not exist within a one quarter (1/4) mile radius, then the closest single water well within either a one quarter (1/4) mile radius or within a one-half (1/2) mile radius shall be selected.

If no water well is located within a one quarter (1/4) mile radius area or if access is denied, a water well within one-half (1/2) mile of the proposed additional well shall be selected. If there are no water quality testing wells meeting the foregoing criteria, then sampling shall not be required. If the BLM or the COGCC have already acquired data on a water well within one quarter (1/4) mile of the conventional well, but it is not the closest water we ll, it shall be given preference in selecting a water quality testing well. The "initial baseline testing" described in this paragraph shall include all major cations and anions, TDS, iron and manganese, nutrients (nitrates, nitrites, selenium), dissolved methane, pH, presence of bacteria and specific conductance and field hydrogen sulfide.

If free gas or a methane concentration level greater than 2 mg/L is detected in a water quality testing well, compositional analysis and carbon isotopic analyses of methane carbon shall be performed to determine gas type (thermogenic, biogenic or an intermediate mix of both). If the testing results reveal biogenic gas, no further isotopic testing shall be done. If the carbon isotope test results in a thermogenic or intermediate mix signature, annual tes ting shall be performed thereafter and an action plan shall be drafted by the operator to determine the source of the gas. If the methane concentration level increases by more than 5 mg/L between sampling periods, or increases to more than 10 mg/L, an action plan shall be drafted to determine the source of the gas.

The initial baseline testing shall occur prior to the drilling of the proposed additional well. Within one (1) year after completion of the proposed additional well, a "post completion" test shall be performed for the same parameters above and repeated three (3) and six (6) years thereafter. If no significant changes from the baseline have been identified after the third test (the six year test), no further testing shall be required. Additional "post c ompletion" test(s) may be required if changes in water quality are identified during follow-up testing. The Director may require further water well sampling at any time in response to complaints from water well owners.

Copies of all test results described above shall be provided to the COGCC, La Plata County or Archuleta County and the landowner where the water quality testing well is located within three (3) months of collecting the samples used for the test.

Plugged and Abandoned Wells The operator shall attempt to identify all plugged and abandoned ("P&A") wells located within one quarter (1/4) mile of a proposed additional well. Any P&A well within one quarter (1/4) mile of a proposed additional well that is identified shall be assessed for risk taking into account cementing practices reported in the P&A. The operator shall notify the Director of the risk assessment of plugging procedures. The Director shall review the risk assessment and take appropriate action to pursue further investigation and remediation if warranted.

Annual Drilling Plan The Director shall survey operators as to their drilling plans for the remainder of the year 2000 and for 2001, and annually thereafter. The survey results shall be reported to the Commission for its consideration with respect to the conditions attached to this order.

Wildlife The operator shall notify the Colorado Division of Wildlife ("CDOW") of the location of any proposed additional well site and advise the Director of the date such notice was provided. If the Director receives comments from the CDOW within ten (10) days of the date notice was provided, such comments may be considered in applying Rule 508 j.(3)B. conditions.

Emergency Preparedness Plan Any operator submitting an Application for Permit-to-Drill for a proposed additional well shall file and maintain a digital Emergency Preparedness Plan ("EPP") with La Plata County or Archuleta County. The EPP shall include as-built facilities maps showing the location of wells, pipelines and other facilities, except control valve locations that which may be held confidential. The EPP shall include an emergency personnel con tact list.

Gas and Oil Regulatory Team The Director shall ensure that the La Plata County Gas and Oil Regulatory Team ("GORT") continues to meet as appropriate, but no less than quarterly. (GORT includes invited member representatives from La Plata County, BLM, Southern Ute Indian Tribe, industry operators and COGCC. Its meetings are open and typically attended by interested area residents.)

3M Mapping, Modelling and Monitoring Project The Director shall ensure that the 3M Technical Peer Review Team is invited to meet as appropriate, but no less than semiannually to review proposals and results related to the 3M Mapping, Modelling and Monitoring Project.

Post Completion Pressure Build-Up Tests In addition to obtaining a bottomhole pressure on all additional wells, operators shall conduct pressure build-up two (2) to three (3) months after initial production begins and once every three (3) years thereafter. The operator shall provide the data acquired, an evaluation of the data and the procedures utilized to conduct the pressure build-up tests to the Director within thirty (30) days of the conclusion of each test. After reviewing the quality of the pressure buildup data and the adequacy of the geographic distribution of the data, the Director may reduce the number of wells for which

pressure build-up testing.

IT IS FURTHER ORDERED, that pursuant to Rule 508.j.(3)B. the Director shall have discretion as described in Exhibit "A" to attach additional conditions to any Applications for Permits-to-Drill additional wells where the surface well location is proposed to be sited on lands subject to Commission jurisdiction.

IT IS FURTHER ORDERED, that the Commission expressly reserves its right, after notice and hearing, to alter, amend or repeal any and/or all of the above orders.

ENTERED this day of July, 2000, as of July 11, 2000.

OIL AND GAS CONSERVATION COMMISSION OF THE STATE OF COLORADO

By Patricia C. Beaver, Secretary Dated at Suite 801 1120 Lincoln Street Denver, Colorado 80203 July 28, 2000

Exhibit "A"

RULE 508 j.(3)B CONDITIONS

The following requirements shall apply to all Applications for Permits-to-Drill additional wells subject to Order Nos. 112-156 and 112-157 where the surface well location is proposed to be sited on lands subject to COGCC jurisdiction in addition to any requirements of applicable existing COGCC rules and regulations:

1.) Prior to approving any Application for Permit-to-Drill, the Director shall conduct an onsite inspection if the surface well location is proposed to be sited within any subdivision that has been approved by La Plata County or Archuleta County or within two (2) miles of the outcrop contact between the Fruitland and Pictured Cliffs Formations.

2.) Prior to approving any Application for Permit-to-Drill, the Director shall conduct an onsite inspection if the operator and the surface owner have not entered into a surface use agreement.

3.) The purpose of the onsite inspection shall be to identify any potential public health, safety and welfare or significant adverse environmental impacts within COGCC jurisdiction regarding the proposed surface location that may not be adequately addressed by COGCC rules or orders. The onsite inspection shall not address matters of surface owner compensation, property value diminution, or any private party contractual issues between the operator and the surface owner.

4.) When the Director conducts onsite inspections under the conditions in 1.) and 2.) above, the Director shall invite the representatives of the surface owner, the operator and local governmental designee ("LGD") to attend. The Director shall attempt to select a mutually acceptable time for the representatives to attend. The inspection shall be conducted within ten (10) days, or as soon as practicable thereafter, of either the date the LGD advises the Di rector in writing that the proposed surface well site location falls within an approved subdivision or the date the operator advises the Director in writing that a surface use agreement has not been reached with the surface owner. If requested by the operator, the Director may delay the onsite inspection to allow for negotiation between the operator and surface owner or other parties.

5.) Following the onsite inspection, the Director shall apply appropriate site specific drilling permit

conditions if necessary to prevent or mitigate public health, safety and welfare or significant adverse environmental impacts taking into consideration cost-effectiveness and technical feasibility and relevant geologic and petroleum engineering conditions as well as prevention of waste, protection of correlative rights, and promotion of development.

6.) Examples of the types of impacts and conditions that might be applied if determined necessary by the Director in 5.) above include (this list is not prescriptive or all inclusive):

a.) visual or aesthetic impacts - moving the proposed surface well site location or access road to take advantage of natural features for screening; installing low profile artificial lift methods; constructing artificial features for screening

b.) surface impacts - moving or reducing the size, shape, or orientation of the surface well site location or access road to avoid disturbance of natural features or to enhance the success of future reclamation activities; utilizing an existing surface well site location or access road to avoid the impacts of new construction; utilizing a closed drilling fluid system instead of reserve pits to avoid impacts to sensitive areas [Note: Directional drilling f rom common surface locations is not a cost-effective or technically feasible option to mitigate surface impacts on 160-acre Fruitland coal seams well density because of the shallow (approximately 2000') target top depths, the long (average 2640') displacements and the resulting complications for artificial lift.]

c.) noise impacts - installing electric motors where practicable; locating or orienting motors or compressors to reduce noise; installing sound barriers to achieve compliance with COGCC rules; confining cavitation completion operations (excluding flaring) to the hours of 7 a.m. to 7 p.m. and notifying all area residents within one-half (1/2) mile at least seven (7) days before cavitation is commenced

d.) dust impacts - watering roads as necessary to control dust during drilling and completion operations

e.) ground water impacts - collecting and analyzing water and gas samples from existing water wells or springs; installing monitoring wells, collecting samples, and reporting water, gas and pressure data

f.) safety impacts - soil gas sampling and analysis; residential crawl space gas sampling and analysis; installing security fencing around wellheads and production equipment

g.) outcrop impacts - performing outcrop gas seep surveys; performing produced water quality analysis; periodic pressure transient testing of high water/gas ratio wells; limiting water production in wells with anomalously high water rates and water/gas ratios; funding investigative reservoir modelling under the Director's supervision

h.) wildlife impacts - limiting drilling and completion operations during certain seasonal time periods when specific site conditions warrant

7.) If the operator objects to any of the conditions of approval applied under 6.) above, the Director shall stay the issuance of the drilling permit and properly notice and set the matter for the next regularly scheduled Commission hearing at which time the Commission may determine conditions of drilling permit approval.

8.) If the Director has reasonable cause to believe that any existing or proposed oil and gas operations are causing, or are likely to cause, public health, safety and welfare or significant adverse environmental impacts within COGCC jurisdiction that may not be adequately addressed by COGCC rules or orders, the

Director may properly notice and set the matter for the next regularly scheduled Commission hearing to order appropriate investigative or remedia l action. Reasonable cause may include, but is not limited to, information from the 3M Mapping, Modelling and Monitoring Project.

The Director shall report in writing to the Commission no later than September 1, 2001, as to Applications for Permits-to-Drill received, onsite inspections conducted, surface use agreements reached and permit conditions applied related to proposed additional wells. The Director, after consultation with the Commission, shall notice for Commission hearing a discussion of such report no later than December 15, 2001. ??

7 (112-157)

Cause Index

Main Index

COGCC APPROVED INCREASED DENSITY APPLICATIONS
(AS OF 8/31/00)

OPERATOR	LEGAL LOCATION		UNIT	TYPE	ORDER #
Vastar	NW ¼ NW ¼	14-T32N-R9W	W ½	RC	112-119
Vastar	SE ¼ SE ¼	14-T32N-R9W	E ½	RC	112-120
Vastar	NE ¼ SE ¼	13-T32N-R9W	E ½	RC	112-121
Cedar Ridge	SE ¼ NW ¼	5-T32N-R11W	W ½	RC	112-124
Cedar Ridge	SE ¼ SE ¼	7-T32N-R11W	E ½	RC	112-125
Red Willow	NW ¼ NW ¼	17-T32N-R11W	W ½	RC	112-130
Texaco	E ½	10-T32N-R9W	E ½	DR	112-133
Texaco	NW ¼ SW ¼	34-T33N-R9W	W ½	RC	112-134
Red Willow	various lands (Mesa Mountain)				112-136
Petrogulf	SW ¼ SW ¼	31-T33N-R9W	S ½	DR	112-137
J.M Huber	various land				112-138
Vastar	N ½	8-T32N-R9W	E ½	RC	112-139
Vastar	W ½	20-T33N-R10W	W ½	RC	112-140
Vastar	S ½	18-T3N-R10W	S ½	RC	112-141
	W ½, E ½	19-T33N-R10W	W ½ E ½	RC	112-141
Red Willow	various lands				112-143
Vastar	E ½	30-T33N-R10W	E ½	DR	112-144
Vastar	various lands				112-145
Four Star	NW ¼ NE ¼	9-T33N-R10W	E ½	RC	112-146
Four Star	NE ¼ NE ¼	24-T33N-R10W	E ½	RC	112-147
Amoco	various lands				112-148
Amoco	NE ¼	16-T34N-R8W(S)	N ½	RC	112-149
	SW ¼	35-T35N-R8W	S ½	RC	112-149
Amoco	NE ¼	9-T34N-R8W(N)	E ½	DR	112-152
Amoco	NW ¼	11-T33N-R10W	W ½	RC	112-153
Vastar	various lands			DR	112-154
MarkWest	various lands				112-155
Amoco et al	various lands			DR	112-156
Amoco et al	various lands			DR	112-157

APPENDIX P
HAZARDOUS MATERIALS SUMMARY

APPENDIX P

HAZARDOUS MATERIALS SUMMARY

This Hazardous Materials Summary is provided pursuant to Bureau of Land Management (BLM) Instruction Memoranda Numbers CO-97-023 and WO-93-344, which require that all National Environmental Policy Act (NEPA) documents list and describe any hazardous and/or extremely hazardous materials that would be produced, used, stored, transported, or disposed of as a result of a proposed project. The summary serves as a supplement to the FEIS for Oil and Gas Development on the Southern Ute Indian Reservation.

Materials are considered hazardous if they contain chemicals or substances listed in the Environmental Protection Agency's (EPA's) *Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986.* Extremely hazardous materials are those identified in the EPA's *List of Extremely Hazardous Substances* (40 Code of Federal Regulations [CFR] 355).

Hazardous materials anticipated to be used or produced during the project may come from drilling materials, casing and plugging materials, fracturing materials, production products, fuels, geophysical survey materials, pipeline materials emissions, and miscellaneous materials. Where possible, the quantities of these products or materials have been estimated on a per-well basis. Hazardous and extremely hazardous constituents potentially occurring in these products or materials have been identified and are listed in Table P-1.

Drilling Materials

Water-based drilling fluids consisting of clays and other additives would be utilized by drilling companies for drilling each well. Drilling fluid additives potentially containing hazardous materials are listed in Table P-1. The plyacrilamides used in drilling may contain the extremely hazardous substance acrylamide. Drilling fluid additives would be transported to well locations during drilling operations in appropriate sacks and containers. Drilling fluids, cuttings, and water would be stored in reserve pits located on-site, and reserve pits would be lined as directed by the BLM to conserve water and protect near-surface aquifers. When the reserve pit is no longer required, its contents would be evaporated or solidified in place and the pit backfilled as approved by the BLM

Cementing and Plugging Materials

Well completion and abandonment operations include cementing and plugging various segments of the well bore to protect freshwater aquifers and other down-hole resources. Wells would be cased

and cemented and approved by the BLM (for federal minerals), and Colorado Oil and Gas Conservation Commission (COGCC) (for state and patented minerals). Cementing and plugging materials potentially containing hazardous materials are listed in TableP-1. The extremely hazardous material acrylamide may be present in fluid loss additives. All casing and plugging materials would be transported in bulk to each well site. Small quantities may be transported and stored on-site in appropriate containers.

Fracturing Materials

Hydraulic fracturing is expected to be performed at all proposed wells to enhance gas flow rates. Fracturing fluids consist primarily of fresh water, but would contain some additives with hazardous constituents as shown in Table P-1. Fracturing materials would be transported to well locations in bulk or in manufacturer's containers. Waste fracturing fluids would be collected in above-ground tanks and/or reserve pits and evaporated, or hauled away from the location and reused at another well or disposed of at an authorized facility.

Table P-1: Hazardous and Extremely Hazardous Materials potentially utilized or produced during construction, drilling, production, and reclamation operations.

Source	Approximate Quantities Used or Produced per Well[1]	Hazardous Substances[2]	Extremely Hazardous Substances[3]	CAS No.
Drilling Materials				
Barite	16,000 lbs	Barium compounds Fine mineral fibers		— —
Bentonite	45,000 lbs	Fine mineral fibers		—
Caustic soda	750 lbs	Sodium hydroxide		1310-73-2
Glutaraldehyde	20 gal	Isopropyl alcohol		67-63-0
Lime	3,500 lbs	Calcium hydroxide		1305-62-0
Mica	600 lbs	Fine mineral fibers		—
Modified tannin	250 lbs	Ferrous sulfate Fine mineral fibers		7720-78-7 —
Phosphate esters	100 gals	Methanol		67-56-1
Polyacrylamides	100 gals	PAHs[4] Petroleum distillates POM[5]	Acrylamide	79-06-1 64742-47-8 —
Retarder	400 lbs	Fine mineral fibers		—
Cementing and Plugging Materials				
Anti-foamer	100 lbs	Glycol ethers		—
Calcium chloride flake	2,500 lbs	Fine mineral fibers		—
Cellophane flake	300 lbs	Fine mineral fibers		—

Cements	77,000 lbs	Aluminum oxide Fine mineral fibers		1344-2-1 —
Chemical wash	850 gals	Ammonium hydroxide Glycol ethers		1336-21-6 —
Diatomaceous earth	1,000 lbs	Fine mineral fibers		—
Extenders	˙17,500 lbs	Aluminum oxide Fine mineral fibers		1344-28-1 —
Fluid loss additive	900 lbs	Fine mineral fibers Napthalene	Acrylamide	79-06-1 — 91-20-3
Friction reducer	160 lbs	Fine mineral fibers Napathalene PAHs POM		— 91-20-3 — —
Mud flash	250 lbs	Fine mineral fibers		—
Retarder	100 lbs	Fine mineral fibers		—
Salt	2,570 lbs	Fine mineral fibers		—
Silica flour	4,800 lbs	Fine mineral fibers		—
		Fracturing Materials		
Biocides	6 gals	Fine mineral fibers PAHs POM		— — —
Breakers	145 lbs	Ammonium persulphate Ammonium sulphate Copper compounds Ethylene glycol Fine mineral fibers Glycol ethers		7727-54-0 7783-20-2 — 107-21-1 — —
Clay stabilizer	50 gals	Fine mineral fibers Glycol ethers Isopropyl alcohol Methanol PAHs POM		— — 67-63-0 67-56-1 — —
Crosslinkers	60 gals	Ammonium chloride Methanol Potassium hydroxide Zirconium nitrate Zirconium sulfate		12125-02-9 67-56-1 1310-58-3 13746-89-9 14644-61-2
Foaming agent	120 gals	Glycol ethers		—
Gelling agent	950 gals	Benzene Ethylbenzene Methyl tert-butyl ether Napthalene PAHs POM Sodium Hydroxide Toluene m-Xylene o-Xylene p-Xylene		71-43-2 100-41-4 1634-04-4 91-20-3 — — 1310-73-2 108-88-3 108-38-2 95-47-6 106-42-3
pH buffers	60 gals	Acetic acid Benzoid acid Fumaric acid Hydrochloric acid Sodium hydroxide		64-19-7 65-85-0 110-17-8 7647-01-0 1310-73-2
Sands	2,000,000 lbs	Fine mineral fibers		—

Solvents	50 gals	Glycol ethers		—
Surfactants	15 gals	Glycol ethers		—
		Isopropyl alcohol		67-63-0
		Methanol		67-56-1
		PAHs		—
		POM		—
		Production Products		
Liquid hydrocarbons	<5-45 bpd	Benzene		71-43-2
		Ethyl benzene		100-41-4
		n-Hexane		110-54-3
		PAHs		—
		POM		—
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Natural gas	0.5>5.0 mmcfd	n-Hexane		110-54-3
		PAHs		—
		POM		—
Produced water/cuttings	0.5-10 bpd water and an unknown quantity of cuttings	Arsenic		7440-38-2
		Barium		7440-39-3
		Cadmium		7440-43-9
		Chromium		7440-47-3
		Lead		7439-92-1
		Manganese		7439-96-5
		Mercury		7439-97-6
		Radium 226		—
		Selenium		7782-49-2
		Uranium		—
		Other radionuclides		—
		Fuels		
Diesel fuel	>36,300 gal	Benzene		71-43-2
		Cumene		98-82-8
		Ethylbenzene		100-41-4
		Methyl tert-butyl ether		1634-04-4
		Napthalene		91-20-3
		PAHs		—
		POM		—
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3
Gasoline	Unknown	Benzene		71-43-2
		Cumene		98-82-8
		Cyclohexane		110-82-7
		Ethylbenzene		100-41-4
		n-Hexane		110-54-3
		Methyl tert-butyl ether		1634-04-4
		Napthalene		91-20-3
		PAHs		—
		POM		—
			Tetraethyl lead	78-00-2
		Toluene		108-88-3
		m-Xylene		108-38-3
		o-Xylene		95-47-6
		p-Xylene		106-42-3

Natural gas	Unknown	n-Hexane PAHs POM		110-54-3 — —
Propane	Unknown	Propylene		115-07-1
		Geophysical Survey Materials		
Explosives, fuses, detonators, boosters, fuels	Unknown	Aluminum Ammonium nitrate Benzene Cumene Ethylbenzene Ethylene glycol Lead compounds Methyl tert-butyl ether Napthalene Nitric acid Nitroglycerine PAHs POM Toluene m-Xylene o-Xylene p-Xylene		7429-90-5 6484-52-2 71-43-2 98-82-8 100-41-4 107-21-1 7439-92-1 1634-04-4 91-20-3 7697-37-2 55-63-0 — — 108-88-3 108-38-3 95-47-6 106-42-3
		Pipeline Materials		
Coating	Unknown	Aluminum Oxide		1334-28-1
Cupric sulfate solution	Unknown	Cupric sulfate Sulfuric acid		7758-98-7 7664-93-9
Diethanolamine	Unknown	Diathanolamine		111-42-2
LP Gas	Unknown	Benzene n-Hexane Propylene		71-43-2 110-54-3 115-07-1
Molecular sieves	Unknown	Aluminum oxide		1344-28-1
Pipeline primer	Unknown	Napthalene Toluene		91-20-3 108-88-3
Potassium hydroxide solution	Unknown	Potassium hydroxide		1310-58-3
Rubber resin coatings	Unknown	Acetone Coal tar pitch Ethyl acetate Methyl ethyl ketone Toluene Xylene		67-64-1 68187-65-5 141-78-6 78-93-3 108-88-3 1330-2-07
		Emissions		
Gases	127 tons[6]	Formaldehyde	 Nitrogen dioxide Ozone Sulfur dioxide Sulfur trioxide	50-00-0 10102-44-0 10028-15-6 7446-09-5 7446-11-9
Hydrocarbons	492 tons[7]	Benzene Ethylbenzene n-Hexane PAHs Toluene m-Xylene o-Xylene p-Xylene		71-43-2 100-41-4 100-54-3 — 108-88-3 108-38-3 95-47-6 106-42-3

Particulate matter	24 tons[8]	Barium Cadmium Copper Fine mineral fibers Lead Manganese Nickel POM Zinc		7440-39-3 7440-43-9 7440-50-8 — 7439-92-1 7493-96-5 7440-02-0 — 7440-66-6
		Miscellaneous Materials		
Acids	Unknown	Acetic anhydride Formic acid Sodium chromate Sulfuric acid		108-24-7 65-18-6 777-11-3 7664-93-09
Antifreeze, heat control, and dehydration agents	300 gals	Acrolein Cupric sulfate Ethylene glycol Freon Phosphoric acid Potassium hydroxide Sodium hydroxide Triethylene glycol		107-02-8 7758-38-7 107-21-1 76-13-1 766-38-2 1310-58-3 1310-73-2 112-27-6
Batteries	Unknown	Cadmium Cadmium oxide Lead Nickel Hydroxide Potassium hydroxide Sulfuric acid		7440-43-0 1306-19-0 7493-92-1 7440-02-0 1310-58-3 7664-93-9
Biocides	Unknown	Formaldehyde Isopropyl alcohol Methanol		50-00-0 67-63-0 67-56-1
Cleaners	Unknown	Hdrochloric acid		7647-01-0
Corrosion inhibitors	Unknown	4-4' methylene dianiline Acetic acid Ammonium bisulfite Basic zinc carbonate Diethylamine Dodecylbenzenesulfonic acid Ethylene glycol Isobutyl alcohol Isopropyl alcohol Methanol Napthalene Sodium nitrite Toluene Xylene		101-77-9 64-19-7 10192-30-0 3486-35-9 109-89-7 27176-87-0 107-21-1 78-83-1 67-63-0 67-56-1 91-20-3 7632-00-0 108-88-3 1330-20-7
Emulsion breakers	Unknown	Acetic acid Acetone Ammnium chloride Benzoic acid Ispropyl alcohol Methanol Napthalene Toluene Xylene Zinc chloride		64-19-7 67-64-1 12125-02-9 65-85-0 67-63-0 67-56-1 91-20-3 108-88-3 1330-20-7 7646-85-7
Fertilizers	Unknown	Unknown		—
Herbicides	Unknown	Unknown		—

Lead-free thread compound	25 gals	Copper Zinc		7440-50-8 7440-66-6
Lubricants	Unknown	1,2,4-trimethylbenzne Barium Cadmium Copper n-Hexane Lead Manganese Nickel PAHs POM Zinc		94-63-6 7440-39-3 7440-43-9 7440-50-8 110-54-3 7439-92-1 7439-96-5 7440-02-0 — — 7440-66-6
Paraffin control	Unknown	Carbon disulfide Ethylbenzene Methanol Toluene Xylene		75-15-0 100-41-4 67-56-1 108-88-3 1330-20-7
Methanol	200 gals	Mdethanol		67-56-1
Motor oil	220 gals	Zinc compounds		—
Paints	Unknown	Aluminum Barium n-Butyl alcohol Cobalt Lead Manganese PAHs POM Sulfuric acid Toluene Triethylamine Xylene		7429-90-5 7440-39-3 71-36-3 7440-48-4 7439-92-1 7439-96-5 — — 7664-93-9 108-88-3 121-44-8 1330-20-7
Photoreceptors	Unknown	Selenium		7782-49-2
Scale inhibitors	Unknown	Acetic acid Ethylene diamine tetra Ethylene glycol Formaldehyde Hydrochloric acid Isopropyl alcohol Methanol Nitrilotriacetic acid		64-19-7 60-00-4 107-21-1 50-00-0 7647-01-0 67-63-1 67-56-1 139-13-9
Sealants	Unknown	1,1,1-trichloroethane n-Hexane PAHs POM		71-55-6 110-54-3 — —
Solvents	Unknown	1,1,1-trichloroethane Acetone t-Butyl alcohol Carbontetrachloride Isopropyl alcohol Methyl ethyl ketone Methanol PAHs POM Toluene Xylene		71-55-6 67-64-1 75-65-0 56-23-5 67-63-0 108-10-1 67-56-1 — — 108-88-3 1330-20-7
Starting fluid	Unknown	Ethyl ether		60-29-7
Surfactants	Unknown	Ethylene diamine Isopropyl alcohol Petroleum naptha		107-15-3 67-56-1 8030-30-6

lbs = pounds; gals = gallons; bpd = barrels per day; mmcfd = million cubic feet per day; Unknown = unknown quantities to be listed based on information availability.

Hazardous substances are those constituents listed under the Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986, as amended.

Extremely hazardous substances are those defined in 40 CFR 355.

PAHs = polynuclear aromatic hydrocarbons.

POM = polycryclic organic matter.

Value includes NO_2 (107 tons per well) and SO^2 (20 tons per well) estimates only, as adapted from BLM (1996b).

Value includes volatile organic compound emission estimates only, as adapted from BLM (1996b).

Value includes PM_{10} emission estimates only, as adapted from BLM (1996b).

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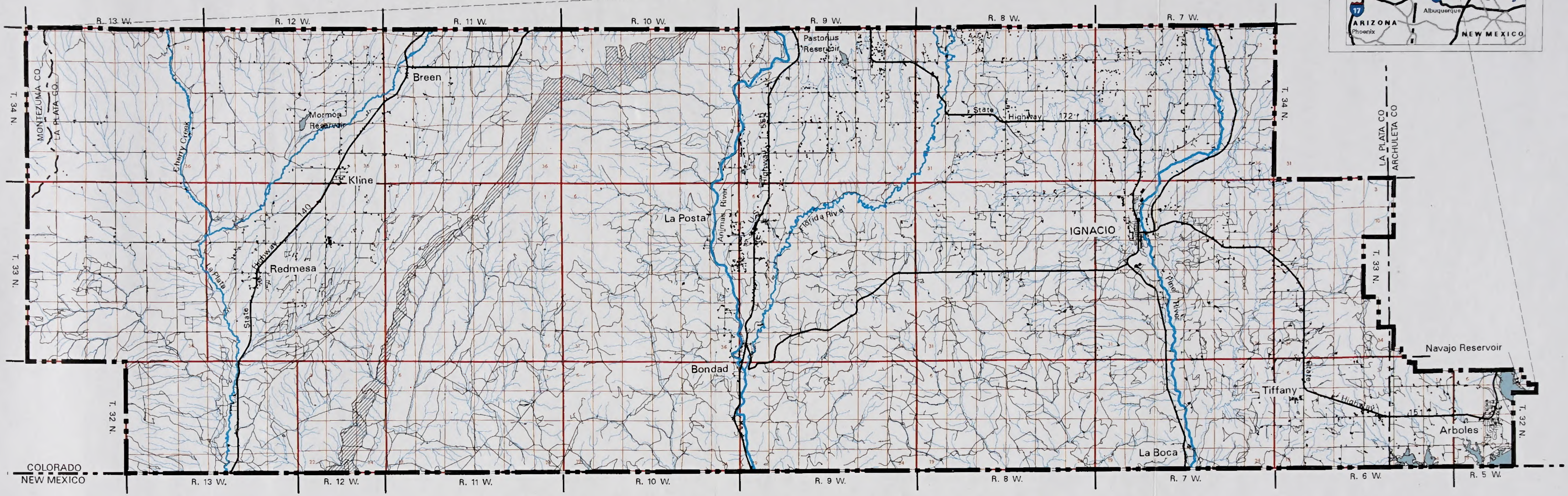
MAPS



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- Stream
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

DAMES & MOORE

SOURCE: Bureau of Indian Affairs, Southern Ute Indian Tribe

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N E S W

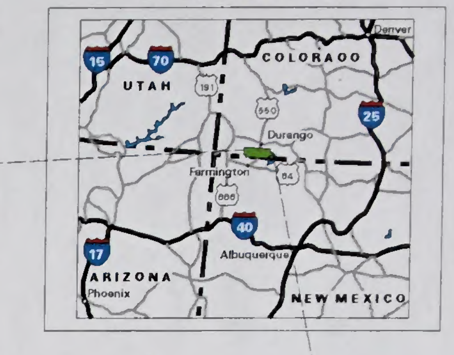
Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

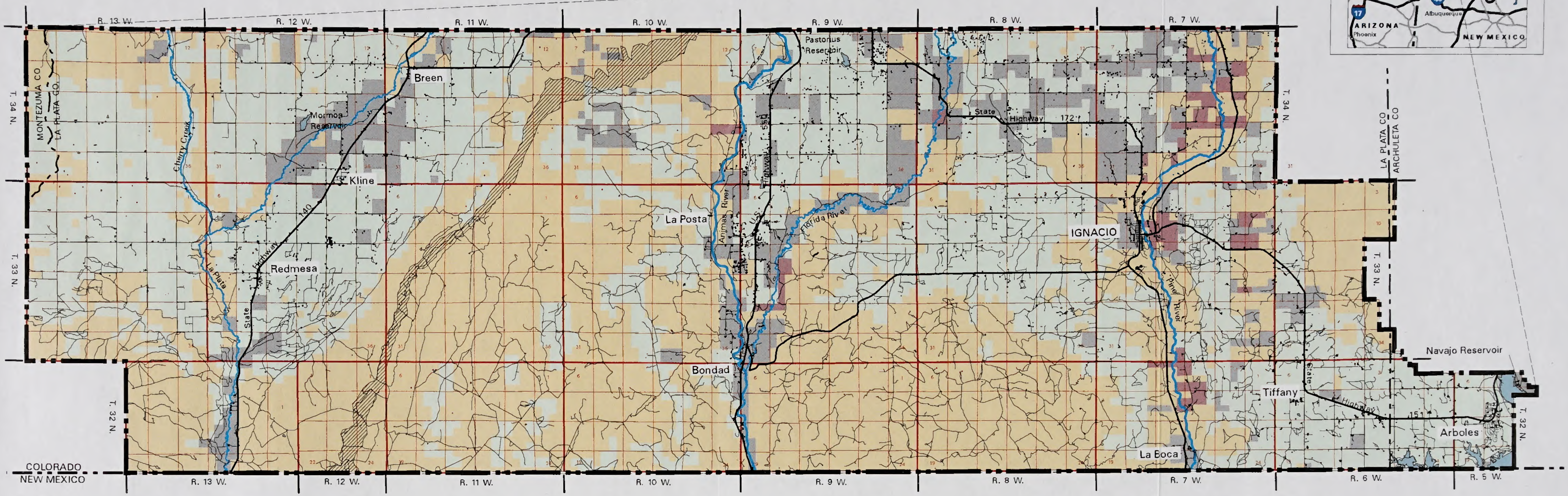
September 08, 1999

Oil and Gas Development on the Southern Ute Indian Reservation EIS

STUDY AREA

MAP 1





General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

- Tribal Coal / Tribal Oil & Gas
- Tribal Coal / Fee Oil & Gas (Disputed Lands)
- Allotted Lands
- Fee Lands

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N E S W

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 09, 1999

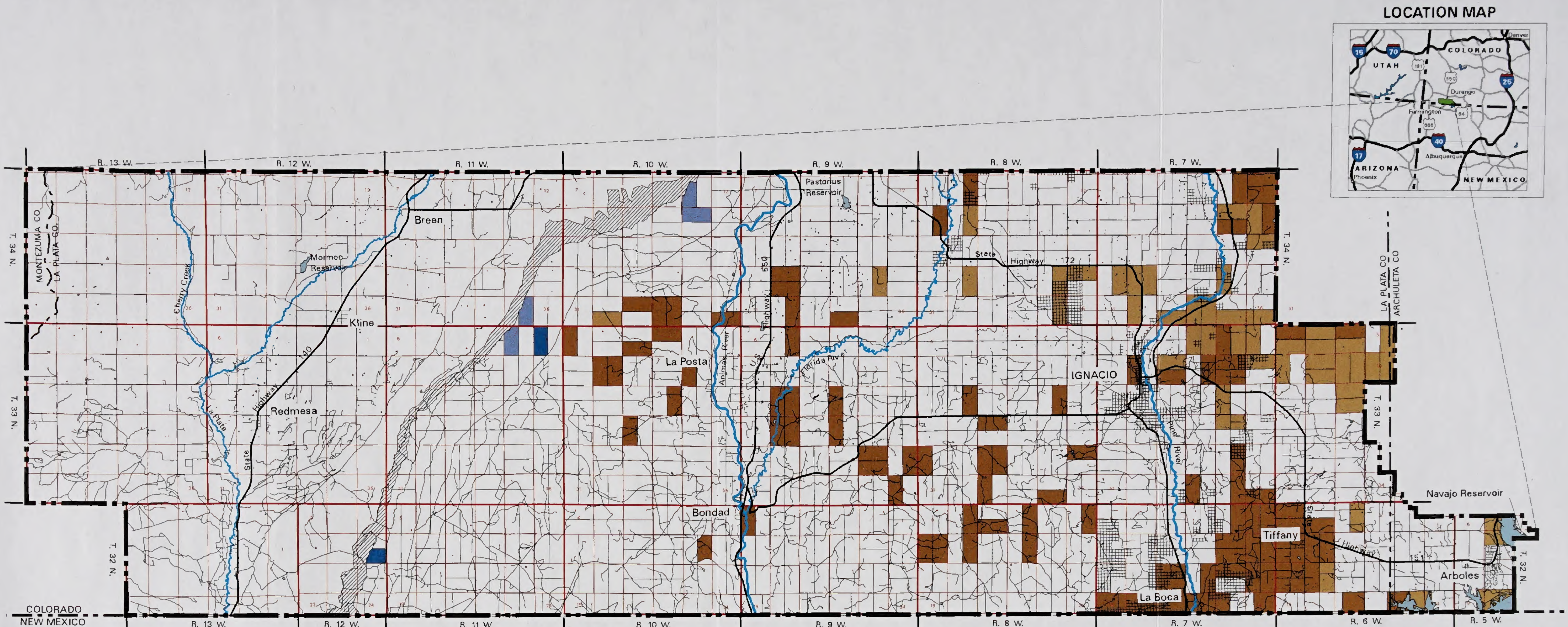
Oil and Gas Development on the Southern Ute Indian Reservation EIS

SUBSURFACE OWNERSHIP

MAP 2

DAMES & MOORE

SOURCE: Southern Ute Indian Tribe Energy Resources Division: 12/14/95



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop

Resource Legend:

- Main region, development window and existing well pad
- Main region, development window without existing well pad
- Buffer region, development window and existing well pad
- Buffer region, development window without existing well pad
- Fairway region, development window and existing well pad
- Fairway region, development window without existing well pad
- Suitable and Available Lands

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N E S W

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 09, 1999

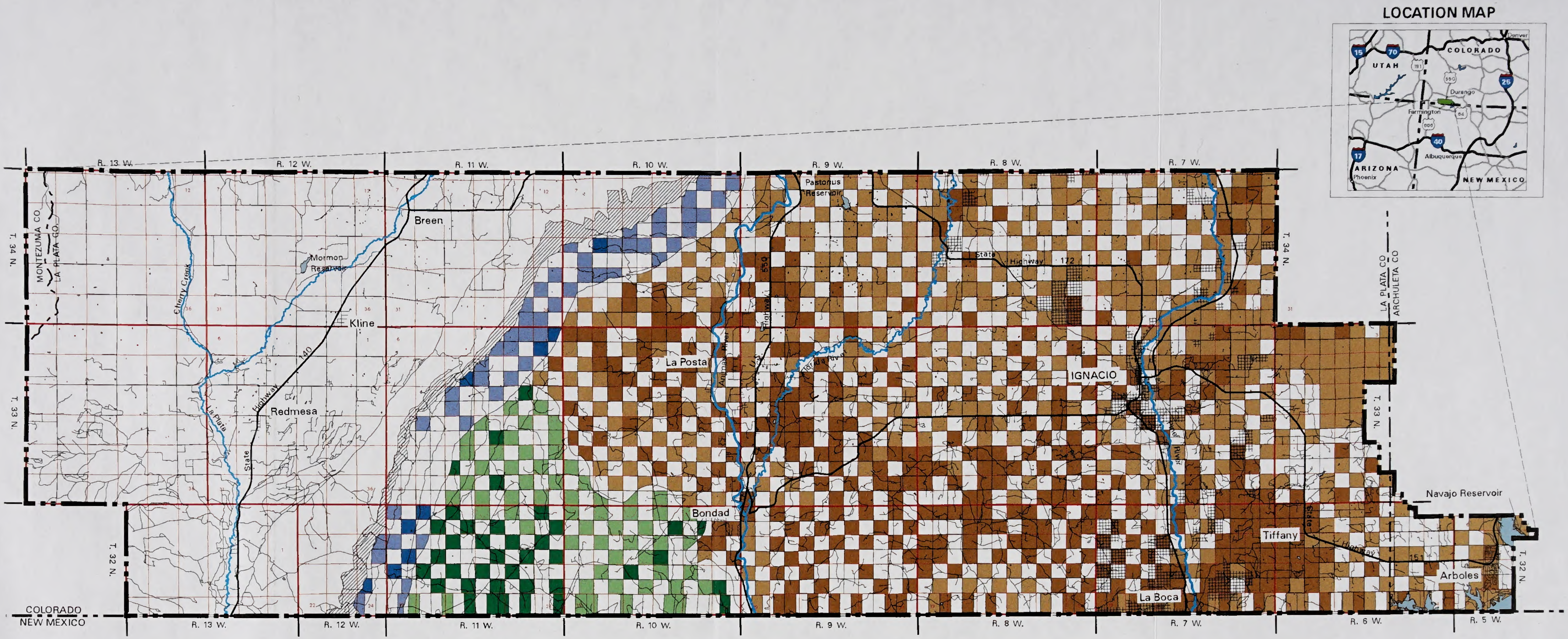
DAMES & MOORE

SOURCE: Dames & Moore, Southern Ute Indian Tribe Energy Resources Division

Oil and Gas Development on the Southern Ute Indian Reservation EIS

320-ACRE DEVELOPMENT WINDOWS ALTERNATIVE 1

MAP 3



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop

Resource Legend:

- Main region, development window and existing well pad
- Main region, development window without existing well pad
- Buffer region, development window and existing well pad
- Buffer region, development window without existing well pad
- Fairway region, development window and existing well pad
- Fairway region, development window without existing well pad
- Suitable and Available Lands

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N W E S

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 09, 1999

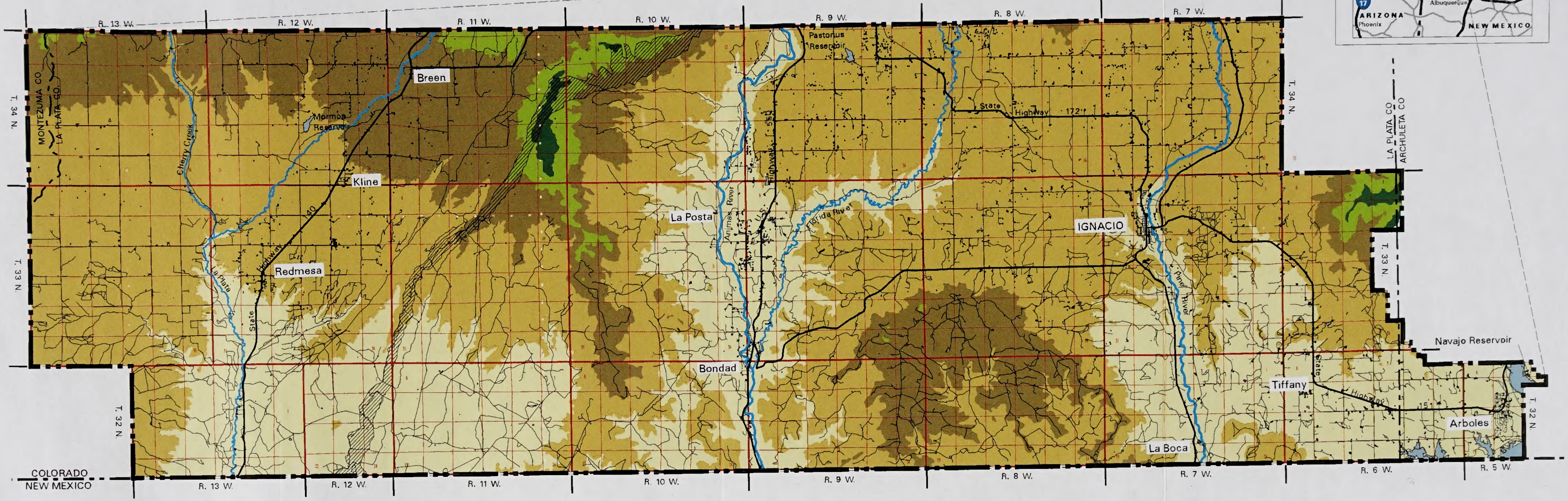
Oil and Gas Development on the Southern Ute Indian Reservation EIS

160-ACRE DEVELOPMENT WINDOWS ALTERNATIVES 2 AND 3

DAMES & MOORE

SOURCE: Dames & Moore, Southern Ute Indian Tribe Energy Resources Division

MAP 4



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

ELEVATION RANGES (in feet)

- 5500 - 6000
- 6000 - 6500
- 6500 - 7000
- 7000 - 7500
- 7500 - 8000
- 8000 - 8500

SOURCE: USGS 30 meter Digital Elevation Model (DEM)

DAMES & MOORE

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N E S W

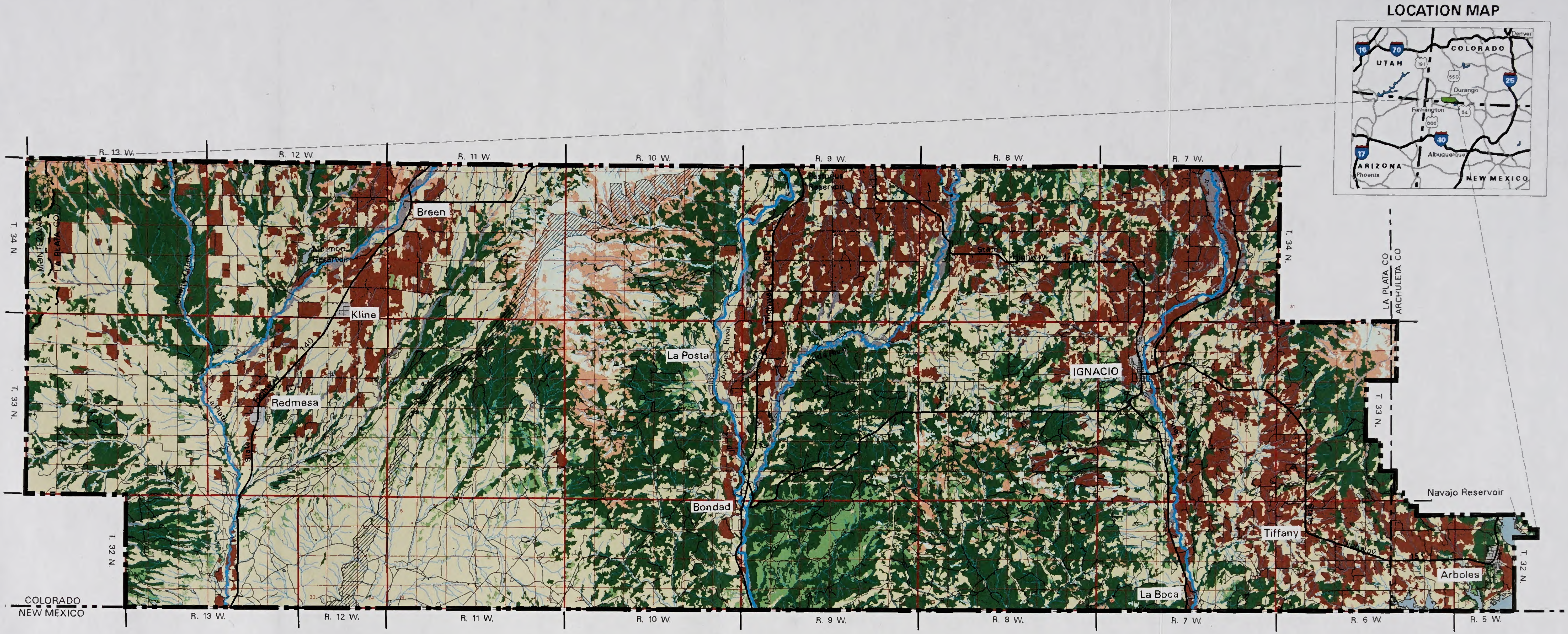
Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 09, 1999

Oil and Gas Development on the Southern Ute Indian Reservation EIS

ELEVATION RANGES

MAP 5



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- Stream
- River
- Lake / Reservoir
- Fruitland Outcrop

Resource Legend:

- Gambel Oak
- Low Density Pinon-Juniper
- Med & Hi Density Pinon-Juniper
- Ponderosa Pine
- Grasslands / Shrublands
- Wooded Riparian
- Water
- Agriculture
- Urban

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

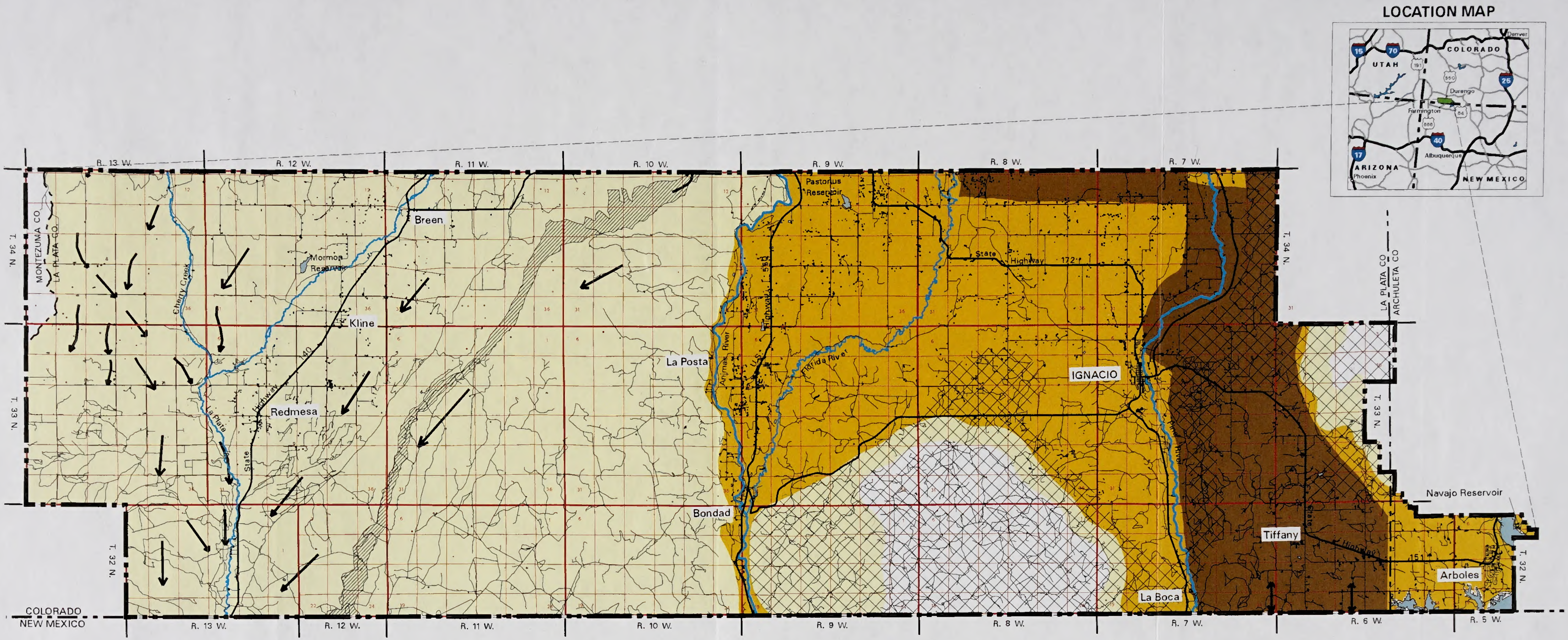
September 07, 1999

DAMES & MOORE

SOURCE: Bureau of Indian Affairs, Landsat TM satellite imagery, 08/02/96

Oil and Gas Development on the
Southern Ute Indian Reservation EIS
VEGETATION TYPES AND DISTRIBUTION

MAP 6



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

- Elk Winter Range
- Elk Severe Winter Range
- Elk Winter Concentration Areas
- Elk Summer Range
- Elk Migration Patterns (Shown with an arrow)

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 09, 1999

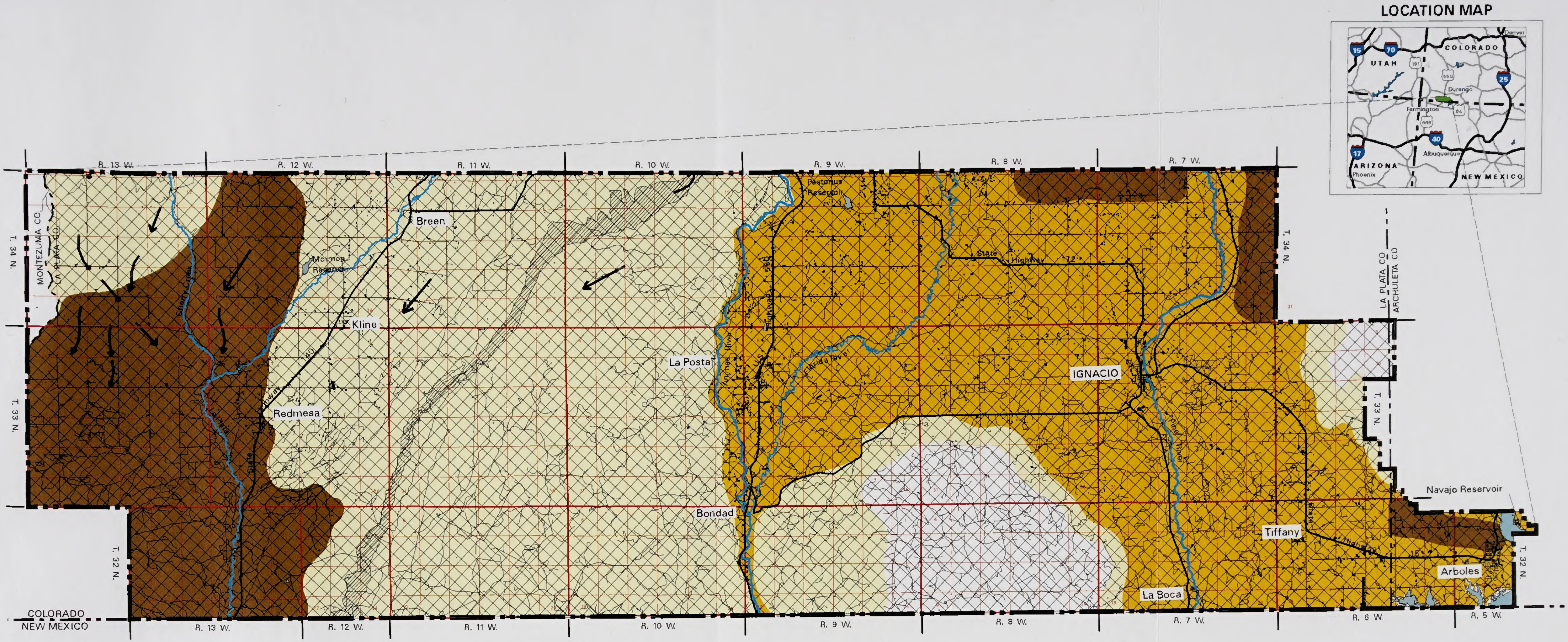
Oil and Gas Development on the Southern Ute Indian Reservation EIS

ELK RANGES AND MIGRATION PATTERNS

MAP 7

DAMES & MOORE

SOURCE: State of CO Division of Wildlife, Department of Natural Resources, 10/96



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

- Deer Winter Range
- Deer Severe Winter Range
- Deer Winter Concentration Areas
- Deer Summer Range
- Deer Migration Patterns (Shown with an arrow)

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 10, 1999

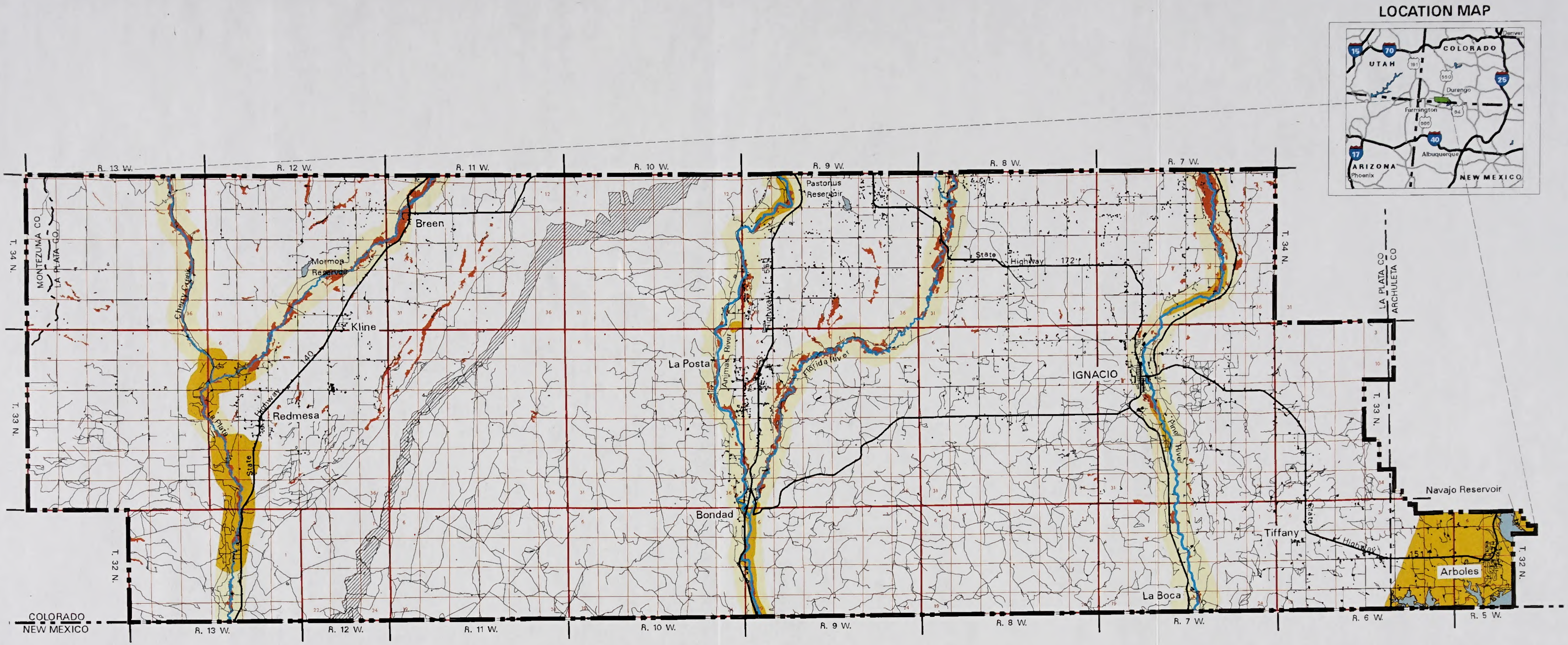
Oil and Gas Development on the
Southern Ute Indian Reservation EIS

MULE DEER RANGES AND MIGRATION PATTERNS

MAP 8

DAMES & MOORE

SOURCE: State of CO Division of Wildlife, Department of Natural Resources, 10/96



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

- Bald Eagle Winter Range
- Bald Eagle Winter Concentration Area
- Southwestern Willow Flycatcher Potential Habitat

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

DAMES & MOORE

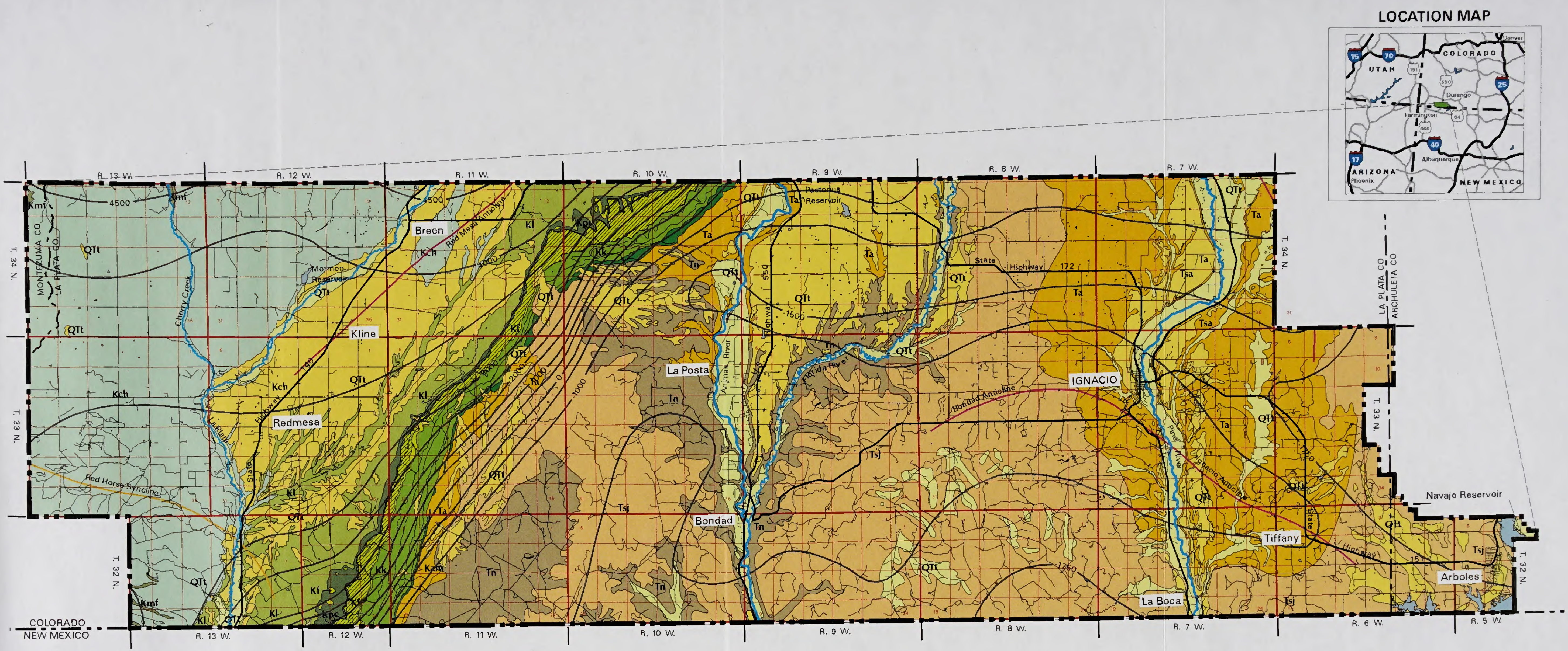
SOURCE: State of CO Division of Wildlife, Department of Natural Resources, 10/96

September 15, 1999

Oil and Gas Development on the
Southern Ute Indian Reservation EIS

SELECTED HABITATS OF THREATENED AND ENDANGERED WILDLIFE SPECIES

MAP 9



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop

Resource Legend:

- Qa Alluvium (Holocene and Pleistocene)
- QTt Terrace Deposits (Pleistocene and Pliocene)
- Tsj San Jose Formation (Eocene)
- Tn Nacimiento Formation (Paleocene)
- Ta Upper part of the Animas Formation (Paleocene)
- Kam Animas Formation McDermott Member (Upper Cretaceous)
- Kk Kirtland Shale (Upper Cretaceous)
- Kf Fruitland Formation (Upper Cretaceous)
- Kpc Pictured Cliffs Sandstone (Upper Cretaceous)
- Kl Lewis Shale (Upper Cretaceous)
- Kch Cliff House Sandstone (Upper Cretaceous)
- Kmf Menefee Formation (Upper Cretaceous)

- Structure Contours (Drawn on base of Dakota Sandstone and Burro Canyon Formation, undivided; contour interval 500 feet; supplementary contour at -1750 feet; datum is mean sea level).
- Anticlines
- Synclines

SOURCE: Based on Condon, 1992 modified with Levings and others, 1990, and Kelly, 1955

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N S E W

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

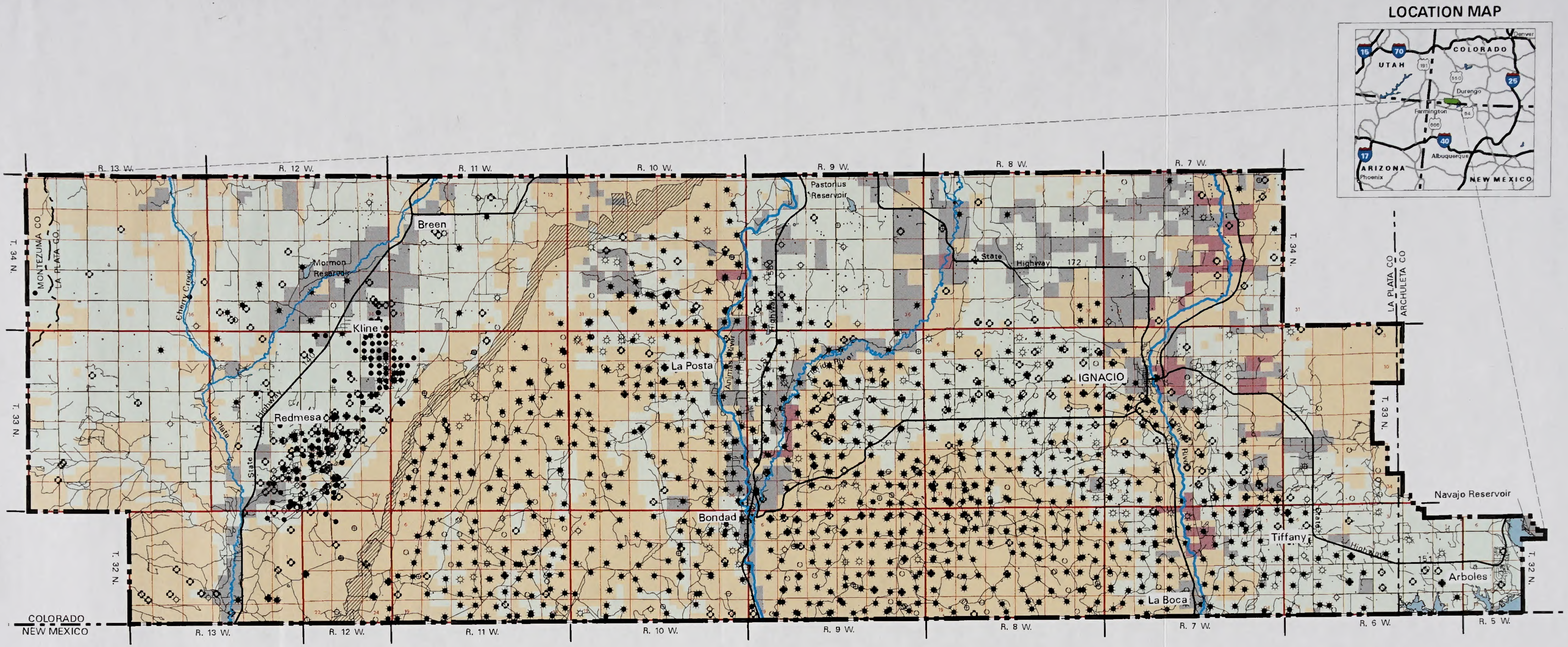
September 10, 1999

Oil and Gas Development on the Southern Ute Indian Reservation EIS

GEOLOGY

MAP 10

DAMES & MOORE



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop

Resource Legend:

- Tribal Coal / Tribal Oil & Gas
- Tribal Coal / Fee Oil & Gas (Disputed Lands)
- Allotted Lands
- Fee Lands
- Producing Gas Well
- Oil Well
- Oil and Gas Well
- Shut-in Gas Well
- Location
- Dry and Abandoned
- Plugged and Abandoned
- Temporarily Abandoned
- Other

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N W E S

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 10, 1999

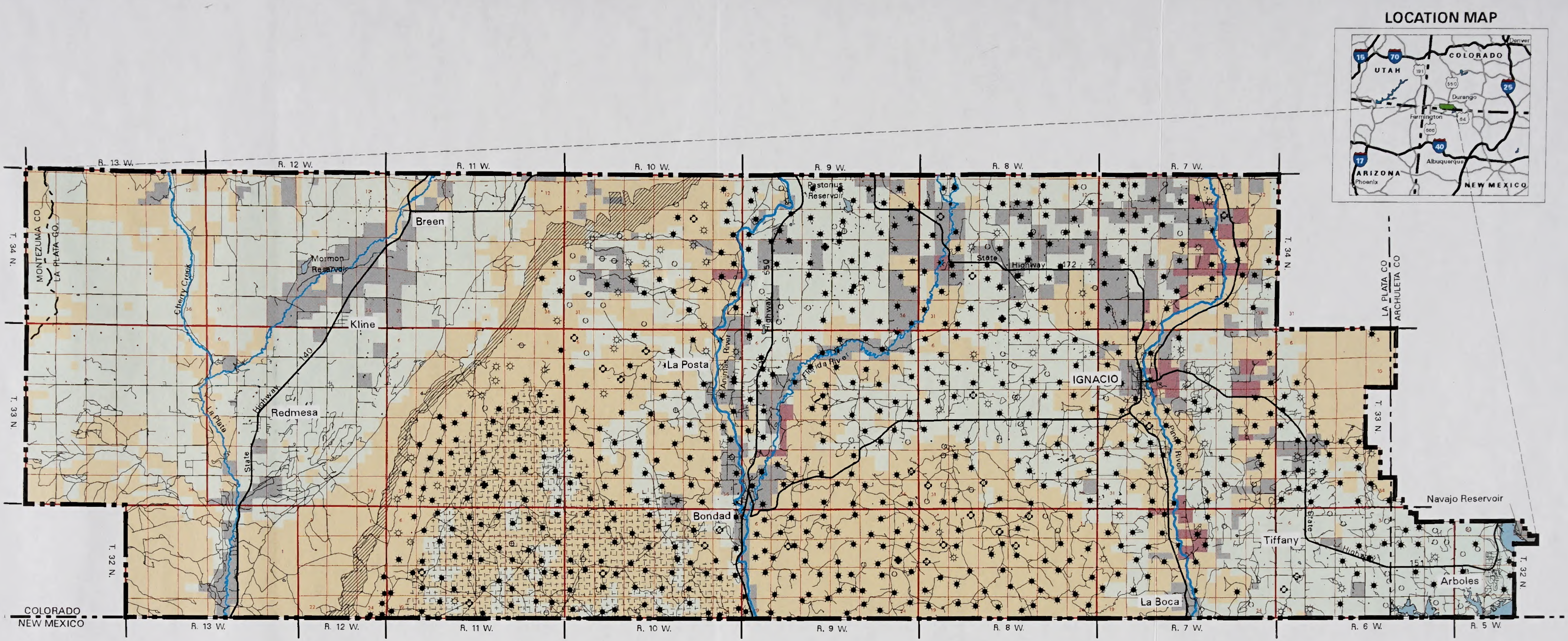
Oil and Gas Development on the Southern Ute Indian Reservation EIS

CONVENTIONAL WELLS AND SUBSURFACE OWNERSHIP

MAP 11

DAMES & MOORE

SOURCE: Well information: Dwights Energy Data, BLM 09/23/96.
Subsurface ownership: Southern Ute Indian Tribe Energy Resources Division: 12/14/95



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop

Resource Legend:

- Tribal Coal / Tribal Oil & Gas
- Tribal Coal / Fee Oil & Gas (Disputed Lands)
- Allotted Lands
- Fee Lands
- Fairway
- Producing Gas Well
- Shut-in Gas Well
- Location
- Dry and Abandoned
- Plugged and Abandoned
- Temporarily Abandoned
- Other

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N W E S

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 14, 1999

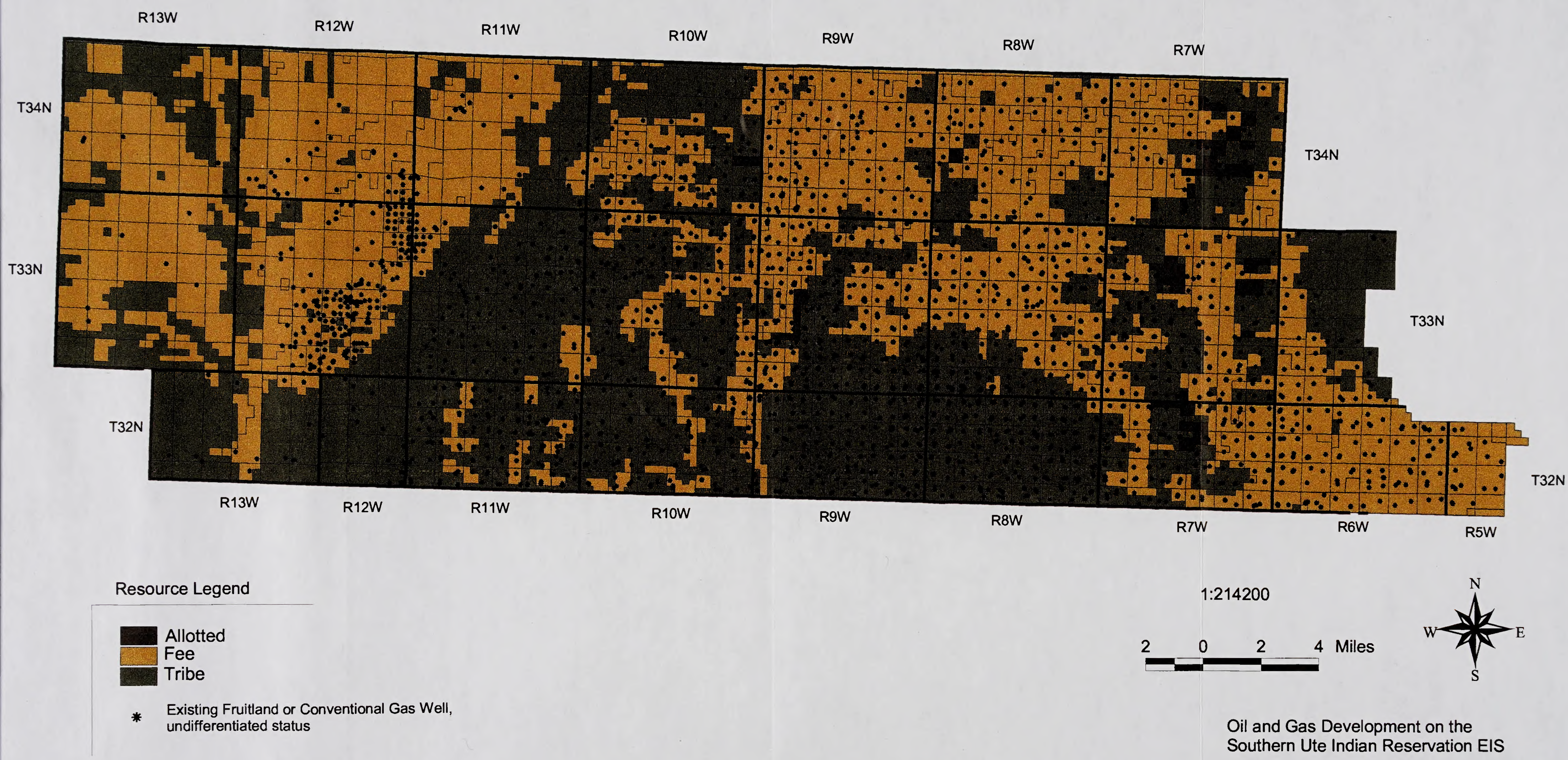
Oil and Gas Development on the Southern Ute Indian Reservation EIS

FRUITLAND WELLS AND SUBSURFACE OWNERSHIP

MAP 12

DAMES & MOORE

SOURCE: Well information: Dwights Energy Data, BLM 09/23/96.
Subsurface ownership: Southern Ute Indian Tribe Energy Resources Division: 12/14/95

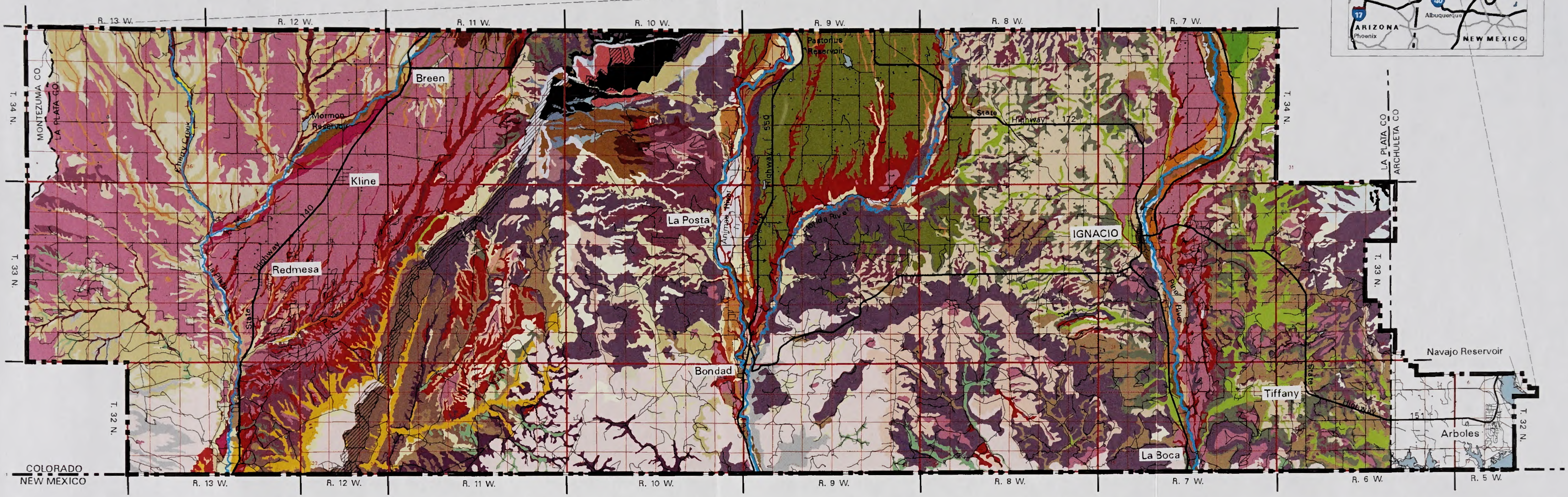


Oil and Gas Development on the Southern Ute Indian Reservation EIS

Source: Colorado Oil and Gas Conservation Commission Website, July 16, 2002.

EXISTING FRUITLAND AND CONVENTIONAL WELLS AS OF JULY, 2002

Addendum to Maps 11 and 12



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop

Resource Legend:

- Agua Fria loam
- Arboles silty clay loam
- Arboles clay
- Archuleta-Sanchez complex
- Baca Variant loam
- Badland
- Bayfield silty clay loam
- Bayfield clay loam gullied
- Bayfield silty clay loam, seeped
- Big Blue clay loam
- Bodot clay
- Buckle loam
- Corta loam 1-3% slopes
- Corta loam 3-8% slopes
- Dulce-Travessilla-Rock outcrop complex
- Durango cobbly loam
- Falfa clay loam 1-3% slopes
- Falfa clay loam 3-8% slopes
- Fluvaquents
- Goldvale very stony fine sandy loam
- Haploborolls-Rubble Land complex
- Harlan cobbly loam
- Harlan cobbly loam, moist
- Herm loam
- Hesperus loam
- Lazear stony loam
- Lazear-Rock outcrop complex
- Mikim loam
- Nehar stony sandy loam
- Nutrioso loam
- Panitchen-Dominguez varient
- Pastorius cobbly loam
- Pescar fine sandy loam
- Picante-Rock outcrop complex
- Pinata loam 1-12% slopes
- Pinata loam 12-40% slopes
- Pits, gravel
- Plome fine sandy loam
- Pulpit loam
- Riverwash
- Rock outcrop
- Sedillo gravelly loam
- Shalona loam
- Sili clay loam 1-3% slopes
- Sili clay loam 3-6% slopes
- Simpatico loam
- Sycle fine sandy loam
- Tefton loam
- Umbarg loam
- Ustic Torriorthents-Ustollic Haplargids complex
- Valto-Rock outcrop complex
- Vernal fine sandy loam
- Vernal-Sedillo complex
- Vosburg fine sandy loam
- Witt loam 1-3% slopes
- Witt loam 3-8% slopes
- Witt loam, eroded
- Yenlo Florita sandy loams
- Zau stony loam
- Zyme clay loam
- Zyme-Rock outcrop complex

NOTE: Soils of the same series have been grouped together for the generalized map; however, detailed analysis is based on phases of the soil series.

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N W E S

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 10, 1999

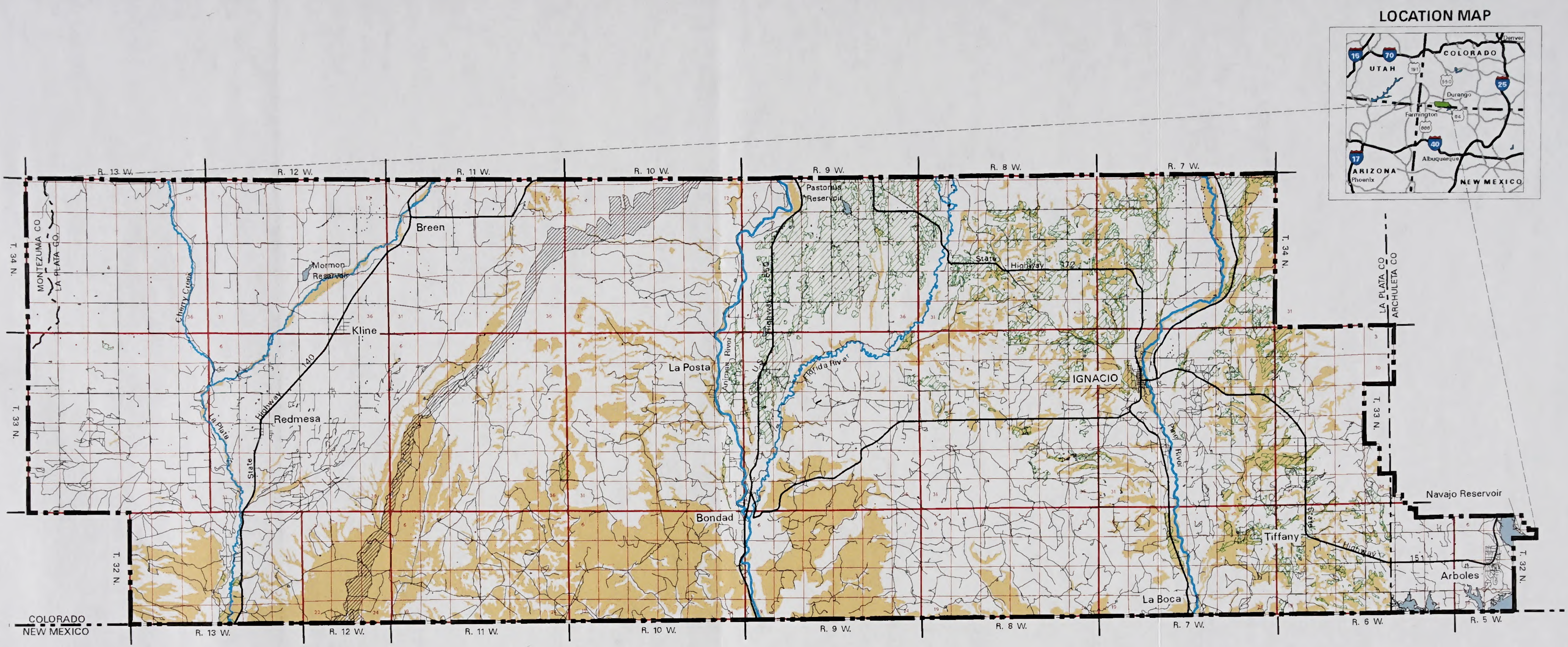
Oil and Gas Development on the Southern Ute Indian Reservation EIS

SOILS

MAP 13

DAMES & MOORE

SOURCE: Southern Ute Indian Tribe Natural Resources Division, Dames & Moore 10/14/96, Natural Resources Conservation Service, 1988



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop

Resource Legend:

- High to Severe Erosion Potential
- Prime Farmland with Irrigation

NOTE: Prime farmland areas were determined from a combination of soil surveys, reclassed Thematic Mapper imagery (irrigated agricultural areas), and slopes of less than 6% derived from 7.5' USGS Digital Elevation Models.

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 10, 1999

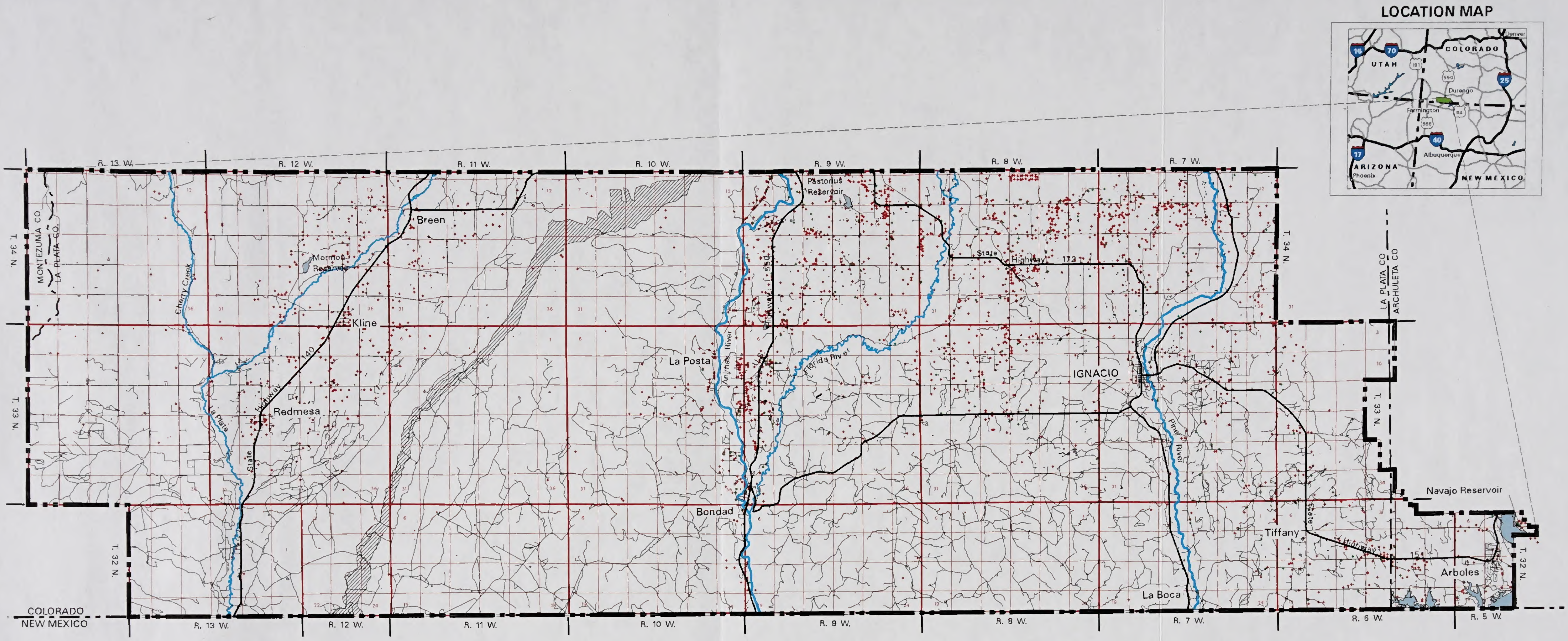
Oil and Gas Development on the Southern Ute Indian Reservation EIS

SOIL EROSION AND PRIME FARMLAND

MAP 14

SOURCE: Southern Ute Indian Tribe Natural Resources Division, Dames & Moore, Natural Resources Conservation Service

DAMES & MOORE



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop

Resource Legend:

- Water wells recorded with the Colorado State Engineer's Office, database provided by the BLM-SJRA
- Wells sampled as part of the COGCC and BLM (1995) Water Well Study of Methane Contamination

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

N W E S

September 13, 1999

Oil and Gas Development on the Southern Ute Indian Reservation EIS

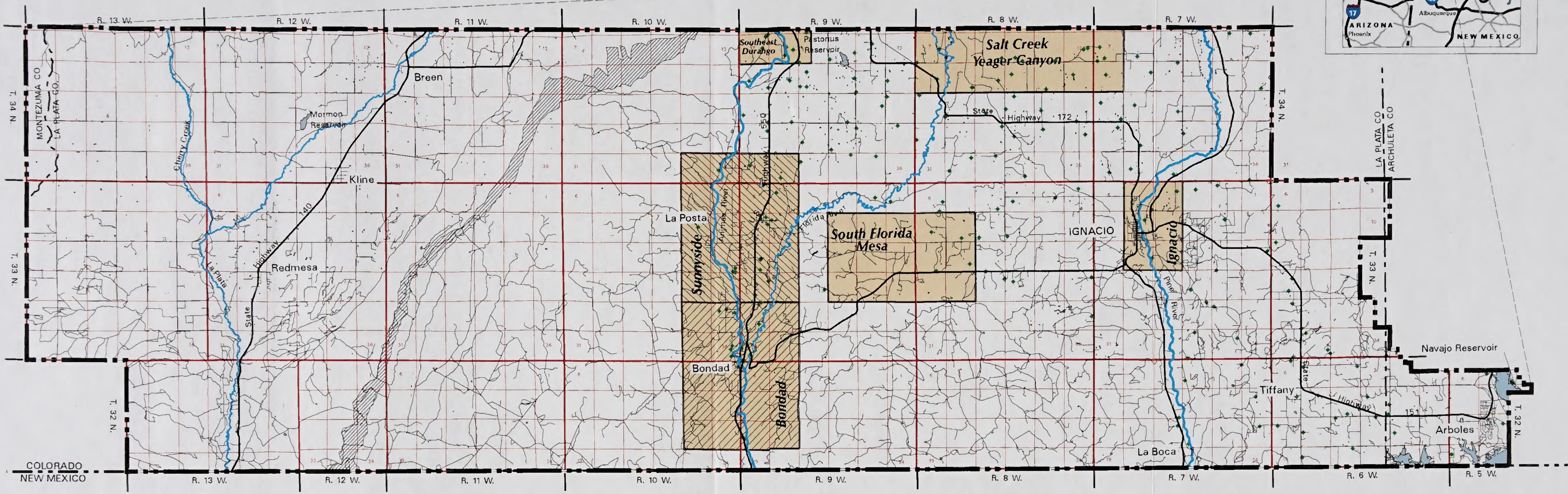
WATER WELLS

MAP 15

DAMES & MOORE

SOURCE: Well information: Dwights Energy Data, BLM 09/23/96.

LOCATION MAP



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop

Resource Legend:

- Area of concern identified in COGCC and BLM 1995
- Wells sampled as part of the COGCC and BLM (1995) Water Well Study of Methane Contamination

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 13, 1999

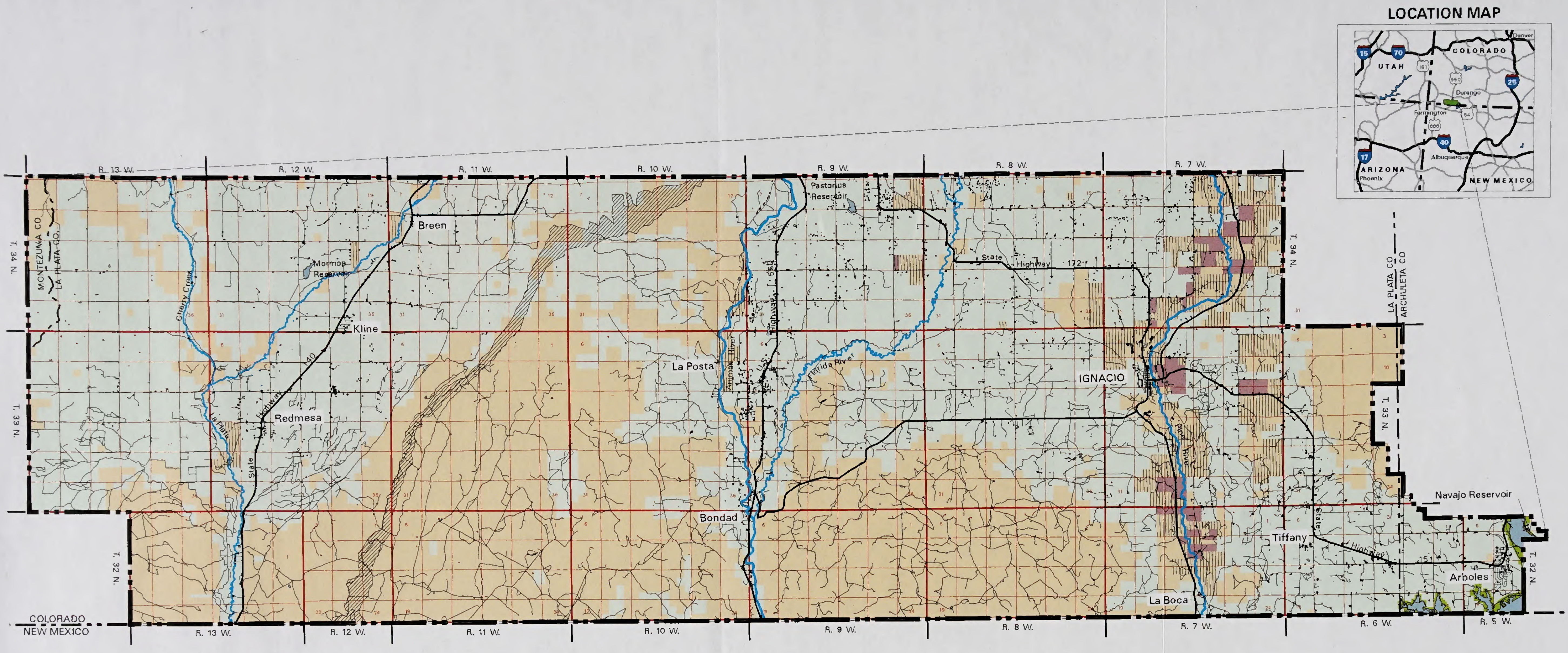
Oil and Gas Development on the Southern Ute Indian Reservation EIS

SAMPLED WATER WELLS AND METHANE CONTAMINATION AREAS OF CONCERN

DAMES & MOORE

SOURCE: Well information: Dwights Energy Data, BLM 09/23/96.

MAP 16



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

- Tribal Trust Lands
- Allotted Lands
- Private Lands
- State of Colorado
- Assigned Lands

Note: The land beneath and immediately surrounding Navajo Reservoir is owned by the federal government.

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 13, 1999

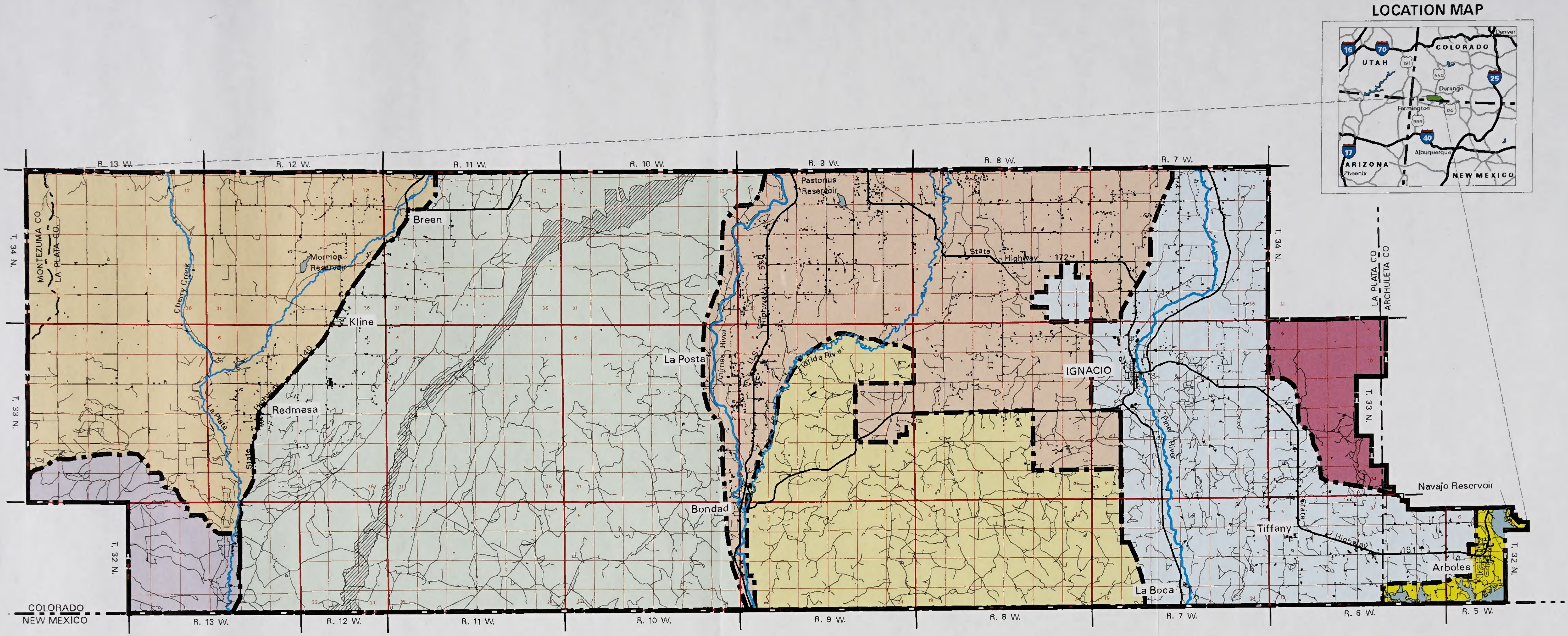
Oil and Gas Development on the Southern Ute Indian Reservation EIS

SURFACE LAND OWNERSHIP

MAP 17

DAMES & MOORE

SOURCE: Bureau of Indian Affairs modified with Southern Ute Indian Tribe Natural Resources Division Data



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

Animas-La Plata Management Unit #1 - Management priorities for this area include identifying and developing irrigable farm lands and developing a land consolidation plan.

Morgan Canyon Management Unit #2 - Management priorities for this area include consolidating land and timber harvesting on approximately 50 acres.

Picnic Flats Management Unit #3 - Management priorities for this area include identifying and setting aside areas for future residential communities, as well as development of a road plan to service multiple uses within this unit including residential, oil & gas, and forestry.

Florida Mesa Management Unit #4 - Management priorities for this area include the establishment of residential communities sites & protecting them from conflicting uses such as Tribal satellite communities and/or long term housing leases. Management priorities for this unit also include developing recreation and fishery potential along the Animas River.

Mesa Mountains Management Unit #5 - Management priorities for this area include creating new animal waters preferably within 1.5 miles of all major forage areas, identifying unnecessary roads, and limiting of gas development disturbances.

Pine River Management Unit #6 - Management priorities for this area include prompting & protecting the growth of cottonwood trees or seedlings, improving access for fishermen, and developing a land consolidation plan.

Sambritos Management Unit #7 - Management priorities for this area include developing a road plan to limit access to future areas of timber and oil and gas, establishing designated cutting blocks in woodland areas, and pursuing reacquisition or stewardship of USFS lands north of Sambritos.

Piedra Management Unit #8 - Management priorities for this area include creating a plan to develop lands adjacent to Navajo Reservoir.

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N E S W

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 13, 1999

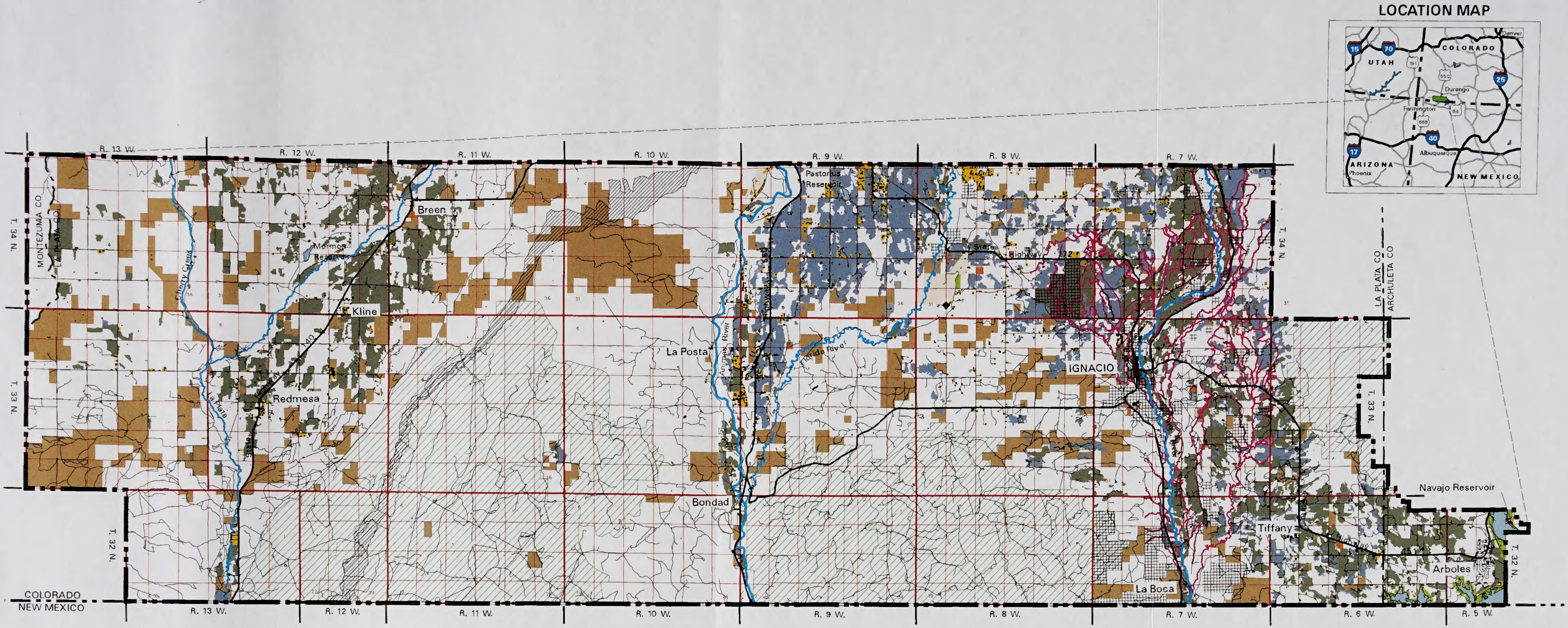
Oil and Gas Development on the Southern Ute Indian Reservation EIS

SUIT RESERVATION MANAGEMENT PLANNING UNITS

MAP 18

DAMES & MOORE

SOURCE: Southern Ute Indian Tribe Natural Resources Division, 1996



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

- Residential
- Commercial
- Recreation
- Industrial
- Public/Quasi-Public
- Agriculture
- Prime Farmland
- Grazing
- SUIT Designated Grazing Units
- Suitable and Available Lands
- Towns
- Tribal or Fee Multiuse Lands
- Pine River Indian Irrigation Project (PRIIP)
- County Airport

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

DAMES & MOORE

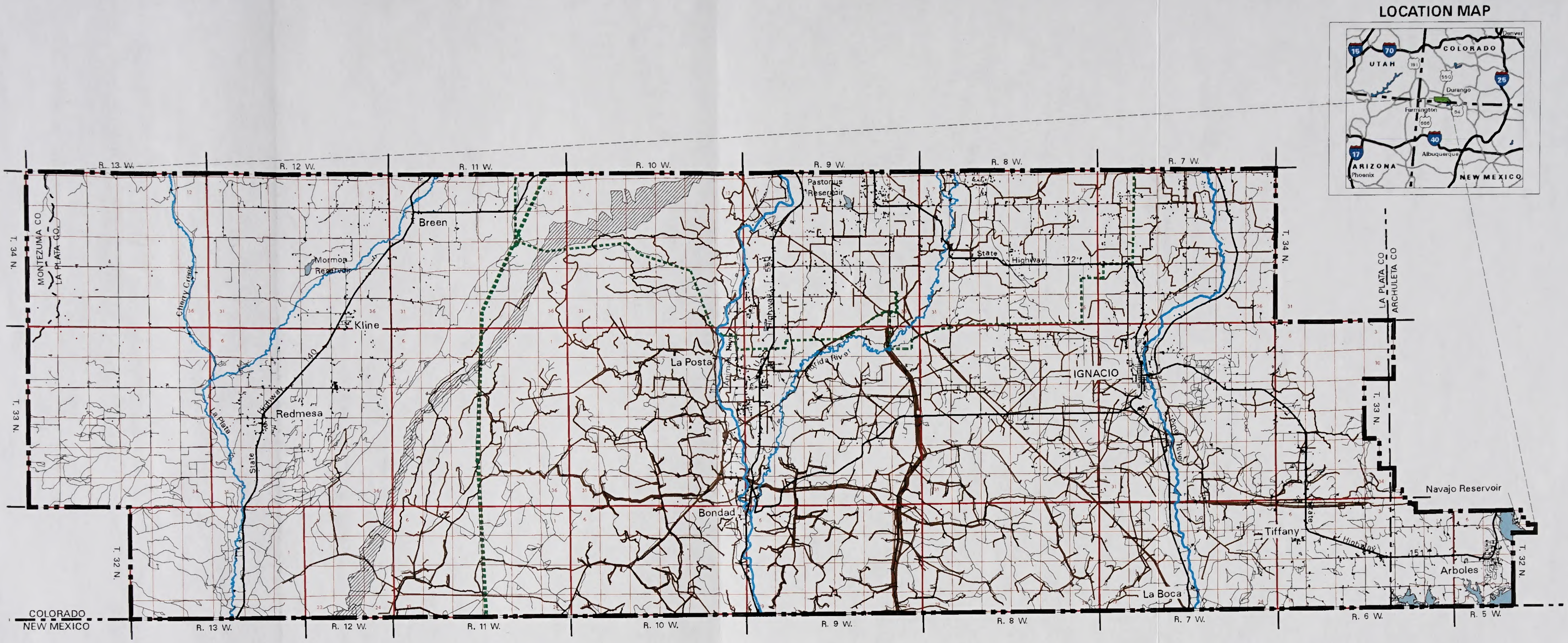
SOURCE: Bureau of Indian Affairs, La Plata County Planning Department, Southern Ute Indian Tribe Natural Resources Division

September 13, 1999

Oil and Gas Development on the Southern Ute Indian Reservation EIS

EXISTING LAND USE

MAP 19



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

- Transmission Lines (69kV and higher)
- Pipelines

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 13, 1999

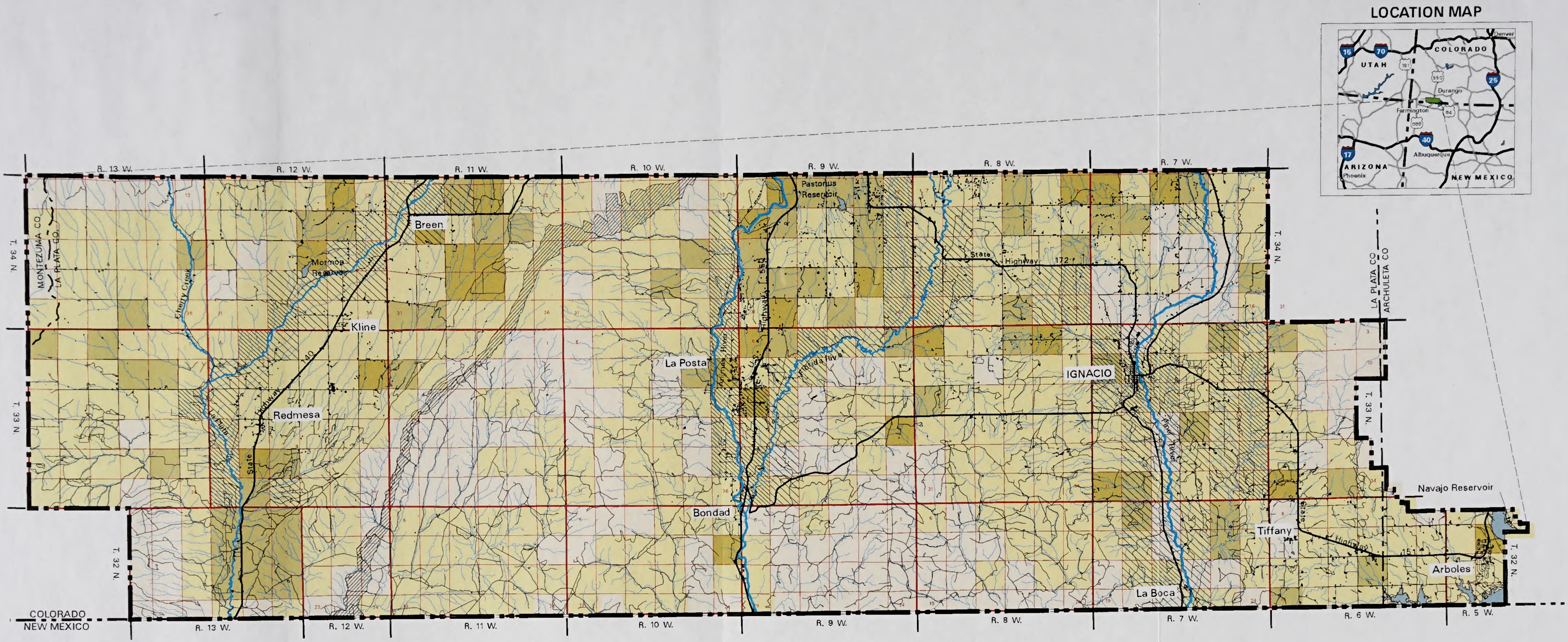
Oil and Gas Development on the Southern Ute Indian Reservation EIS

TRANSPORTATION AND UTILITIES

MAP 20

DAMES & MOORE

SOURCE: Pipelines: Amoco, Southern Ute Indian Tribe Energy Division; Transmission Lines: Laplata Electric Association, Tristate Generation & Transmission Association Inc.



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- Stream
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

INDIAN HISTORIC HOMESTEAD ACTIVITY

- Low - (0 to 2 entries per section)
- Moderate - (3 to 9 entries per section)
- High - (10 to 12 entries per section)
- Very High - (13 to 20 entries per section)
- 1-2 Indian Allotments per Section
- 3-4 Indian Allotments per Section

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 13, 1999

Oil and Gas Development on the Southern Ute Indian Reservation EIS

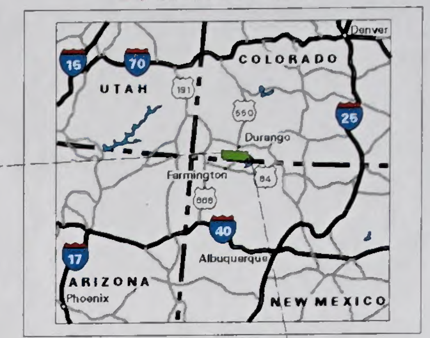
HISTORIC HOMESTEAD AND INDIAN ALLOTMENT ACTIVITY

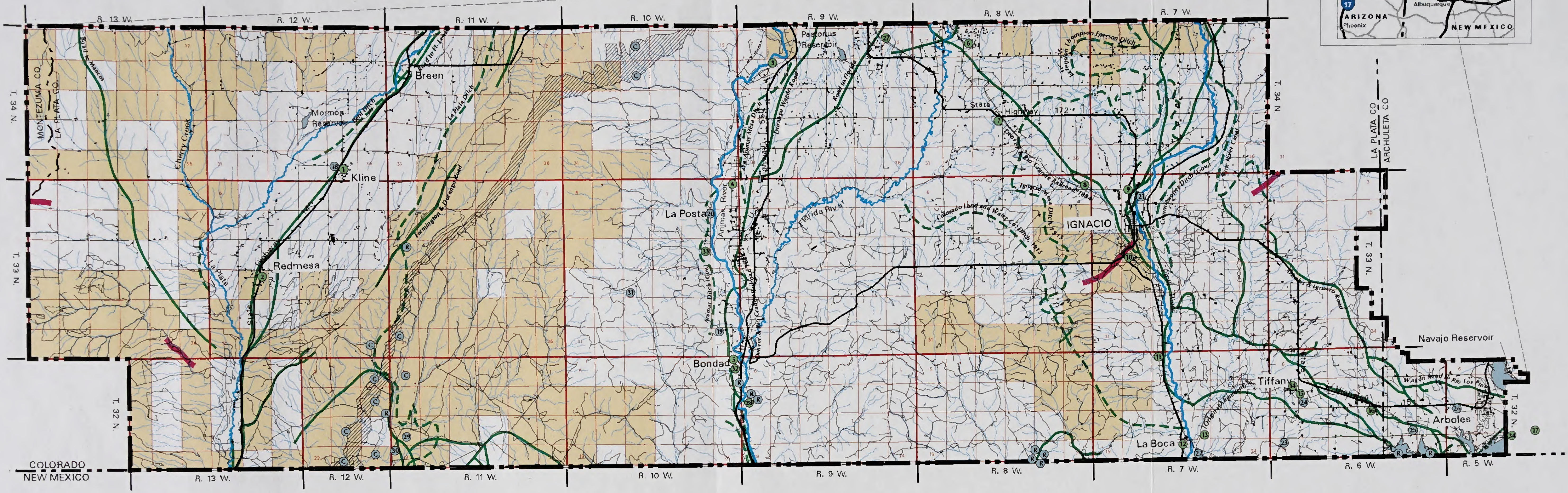
DAMES & MOORE

SOURCE: General Land Office Records on file at CO State Office, BLM

MAP 21

LOCATION MAP





General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- Stream
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

- Oil-Gas Exploration/Development (1922-1928)
- Railroad
- Roads Prior to 1896
- Ditches Prior to 1915
- Indian Trails Prior to 1896

Named Communities:

1. Kline, 1915
2. Redmesa, 1915
3. Lodo, 1915
4. Posta, 1915
5. Bondad, 1915
6. Colina, 1893 (Sloan, 1915)
7. Oxford, 1915
8. Ignacio City, 1915
9. Los Pinos Agency, 1893
10. Ignacio, 1893 (Ignacio Station, 1915)
11. Laboca, 1893
12. Laboca Station, 1915
13. Serano, 1893
14. Tiffany, 1915
15. Ballejo, 1893
16. Allison, 1915
17. Arboles, 1893 & 1915
27. Florida, 1915
28. Colmex, 1915
32. Elco, 1915
33. Casteloir, 1915
34. La Prieda

Other Named Features:

18. Kline Cemetery
19. Elco Cemetery
20. La Posta Cemetery
21. Ouray Memorial Cemetery
22. Unnamed Cemetery
23. Tiffany Cemetery
24. Allison-Tiffany Cemetery
25. Unnamed Cemetery
26. "Graves"
29. Hubbard Reservoir (proposed), 1915
30. Colmex Reservoir (proposed), 1915
31. Brown Sawmill, 1915

- C Noted Coal Deposits prior to 1896
- R Ranches or other agricultural structures prior to 1896

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N W E S

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 13, 1999

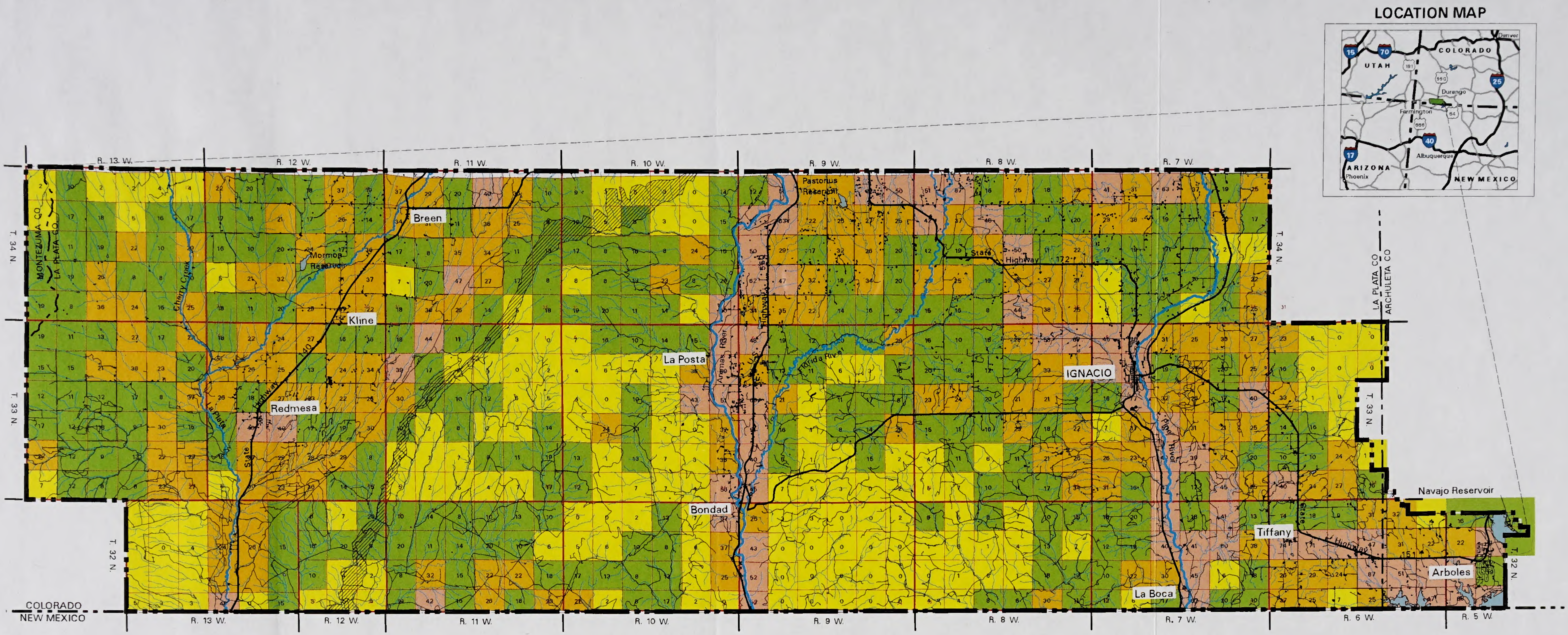
Oil and Gas Development on the Southern Ute Indian Reservation EIS

HISTORIC RESOURCES INVENTORY

DAMES & MOORE

SOURCE: General Land Office Records on file at CO State Office, BLM

MAP 22



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- Stream
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

DAMES & MOORE

Resource Legend:

NON-INDIAN HISTORIC HOMESTEAD SENSITIVITY

- Extremely Low - (0-7 entries per section)
- Low - (8-20 entries per section)
- Moderate - (21-38 entries per section)
- High - (39 to 80 entries per section)

SOURCE: Colorado Historical Society Site Database 09/26/96

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N S E W

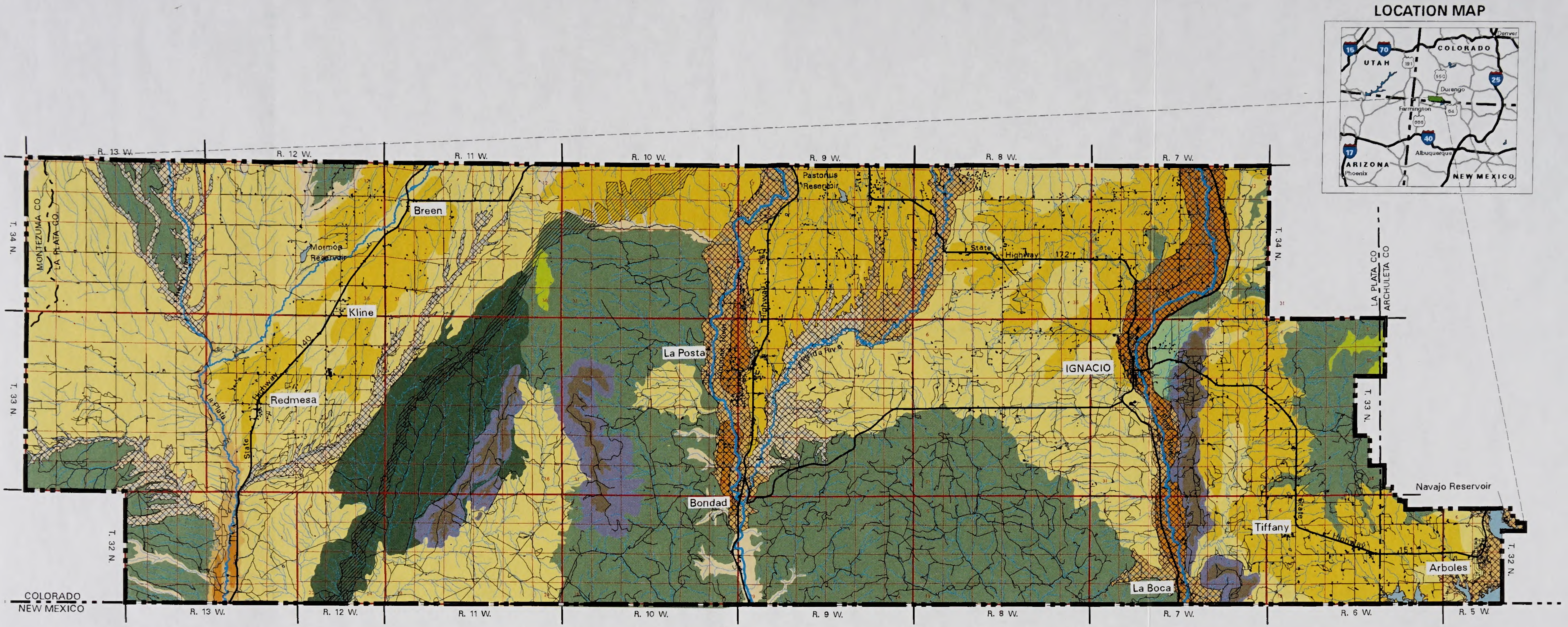
Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 14, 1999

Oil and Gas Development on the Southern Ute Indian Reservation EIS

NON-INDIAN HOMESTEADING CULTURAL SENSITIVITY

MAP 23



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- Stream
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

- Canyon
- River Valley
- River Valley/Agricultural
- Rolling Upland
- Rolling Upland/Agricultural
- Upland Hills
- Upland Hills/Agricultural
- Mesa Rim
- Mesa Top
- Ridges and Narrow Valleys
- Mountain
- Reservoir
- High Scenic Attractiveness

DAMES & MOORE

SOURCE: Dames & Moore, 1996

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N W E S

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

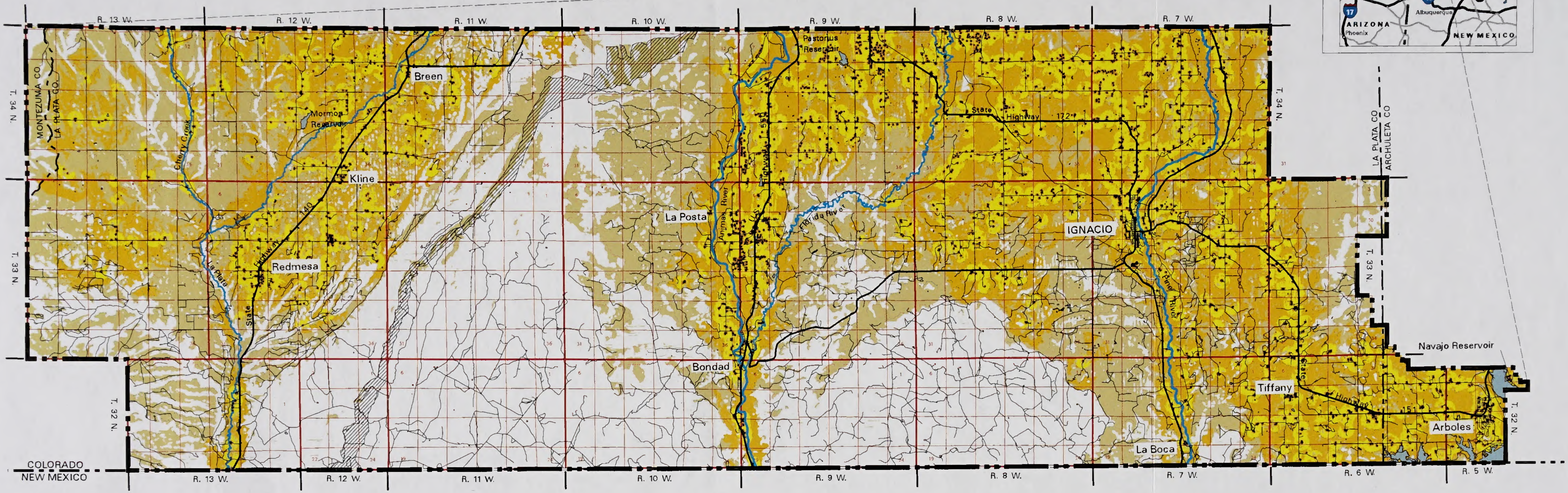
September 07, 1999

Oil and Gas Development on the Southern Ute Indian Reservation EIS

LANDSCAPE CHARACTER

MAP 24

LOCATION MAP



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

VISIBILITY RANGES

- Immediate foreground views (0'-300')
- Foreground views (300'-1/4 mile)
- Middleground views (1/4 mile - 1 mile)
- Background views (1 mile - 5 miles)
- Seldom seen views or > 5 miles

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 08, 1999

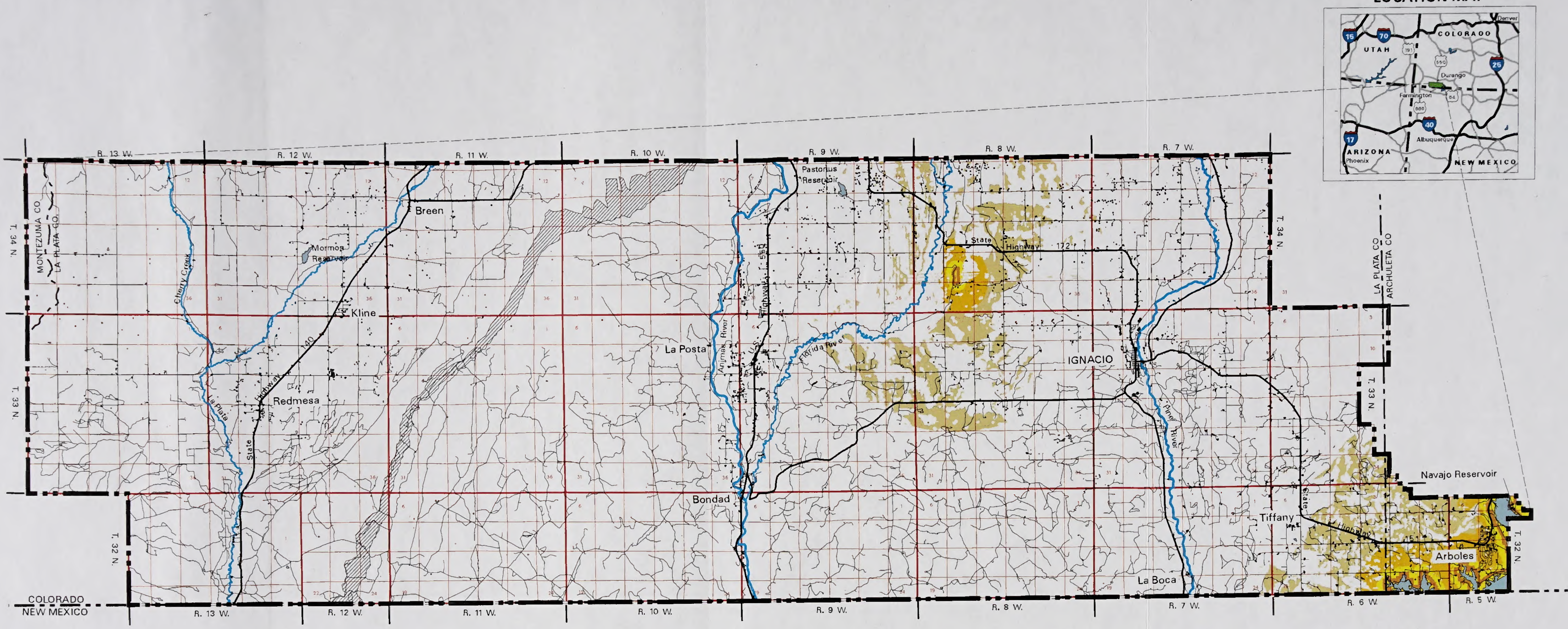
Oil and Gas Development on the Southern Ute Indian Reservation EIS

VISIBILITY FROM RESIDENCES

DAMES & MOORE

SOURCE: United States Geological Survey 30 Meter Digital Elevation Model
Dames & Moore, 1996

MAP 25



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

VISIBILITY RANGES

- Immediate foreground views (0'-300')
- Foreground views (300'-1/4 mile)
- Middleground views (1/4 mile - 1 mile)
- Background views (1 mile - 5 miles)
- Seldom seen views or > 5 miles

SCALE 1 : 214200

1 0 1 2 3 4 MILES

N W E S

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 08, 1999

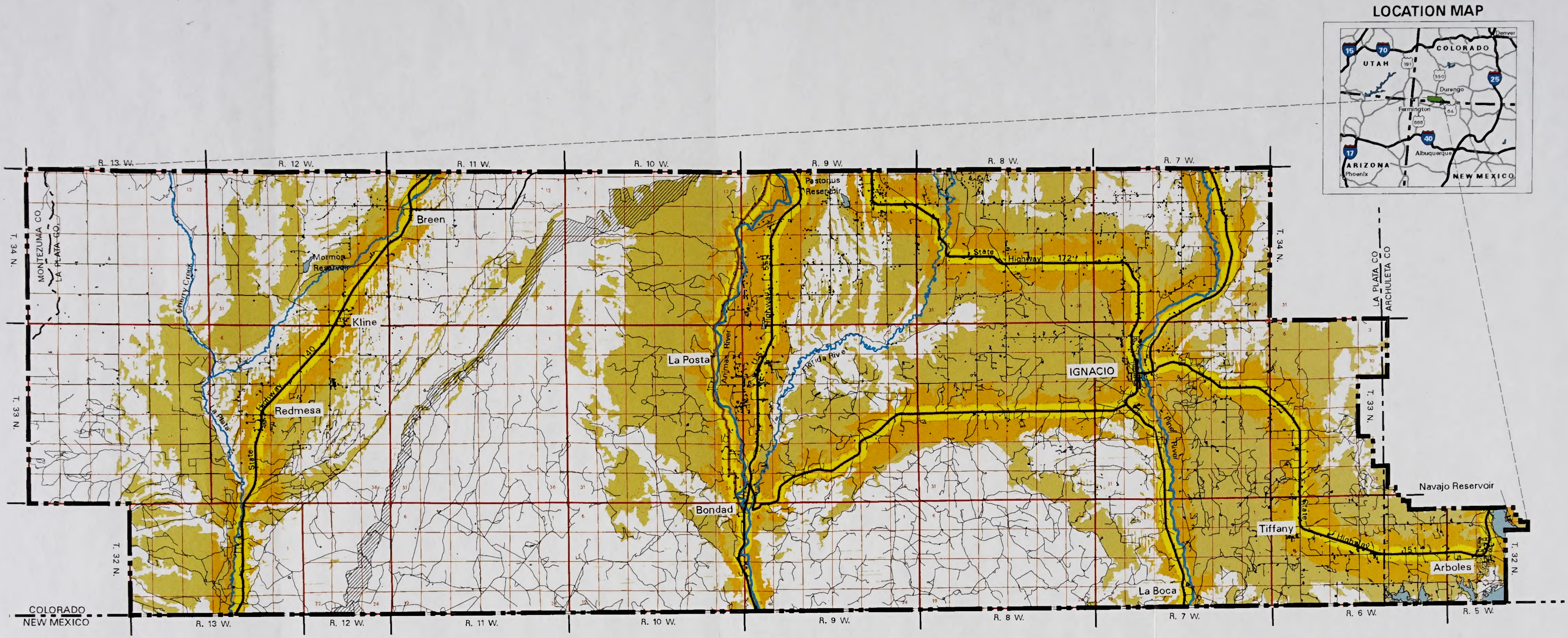
Oil and Gas Development on the Southern Ute Indian Reservation EIS

VISIBILITY FROM RECREATION

MAP 26

DAMES & MOORE

SOURCE: United States Geological Survey 30 Meter Digital Elevation Model
Dames & Moore, 1996



General Reference Features:

- Township/Range Lines
- Section Lines
- Road
- Highway
- Study Boundary
- State Line
- County Line
- River
- Lake / Reservoir
- Fruitland Outcrop
- Residence

Resource Legend:

VISIBILITY RANGES

- Immediate foreground views (0'-300')
- Foreground views (300'-1/4 mile)
- Middleground views (1/4 mile - 1 mile)
- Background views (1 mile - 5 miles)
- Seldom seen views or > 5 miles

SCALE 1 : 214200

1 0 1 2 3 4 MILES

Stateplane Coordinate System
Zone 3501, Units U.S. Survey Feet
NAD27 Horizontal Datum, NAVD29 Vertical Datum

September 08, 1999

Oil and Gas Development on the
Southern Ute Indian Reservation EIS

VISIBILITY FROM KEY TRAVEL ROUTES

DAMES & MOORE

SOURCE: United States Geological Survey 30 Meter Digital Elevation Model
Dames & Moore, 1996

BLM CRITICAL STUDY AREAS*

* Areas selected for ongoing water studies, based on the following three factors: 1) A ½ mile radius from groundwater wells demonstrating entrained methane concentrations greater than 1.0 mg/L as of 3/31/98, or 2) A one mile buffer zone around the Tiffany Enhanced Recovery Unit, or 3) A ½ mile buffer zone around the 1992 HD Mountains EIS Study Area.